# CIVIL ENGINEERING

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

# GALION VIBROSTATIC COMPACTION ..

## TWO Efficient Machines in ONE

**You can roll or vibrate separately or do both at the same time. One man operated—all operations are easy. Maintenance cost is low. Simplicity of maintenance is outstanding.**

### *VIBRATORY COMPACTION*

**The vibrating action of these units is so effective that you can often attain specified densities for granular soil bases in one pass.**

### *STATIC COMPACTION*

**All the usual rolling operations can be done by the 3-wheel roller—simply raise the vibratory unit hydraulically and proceed with all roller compaction jobs, sealing in the surface materials or smoothing the finished surfaces.**

### *BONUS USES*

**The vibrator power generating unit can be operated separately to provide 110 volts for electric lights or for driving small tools.**

*Write for literature on the—*

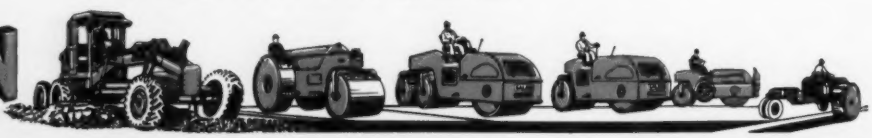
**GALION 3-WHEEL ROLLER with ELECTRIC VIBRATORY COMPACTOR**

**THE GALION IRON WORKS & MFG. CO.**

*General and Export Offices—Galion, Ohio, U.S.A.*

**Cable Address—GALIONIRON, Galion, Ohio**

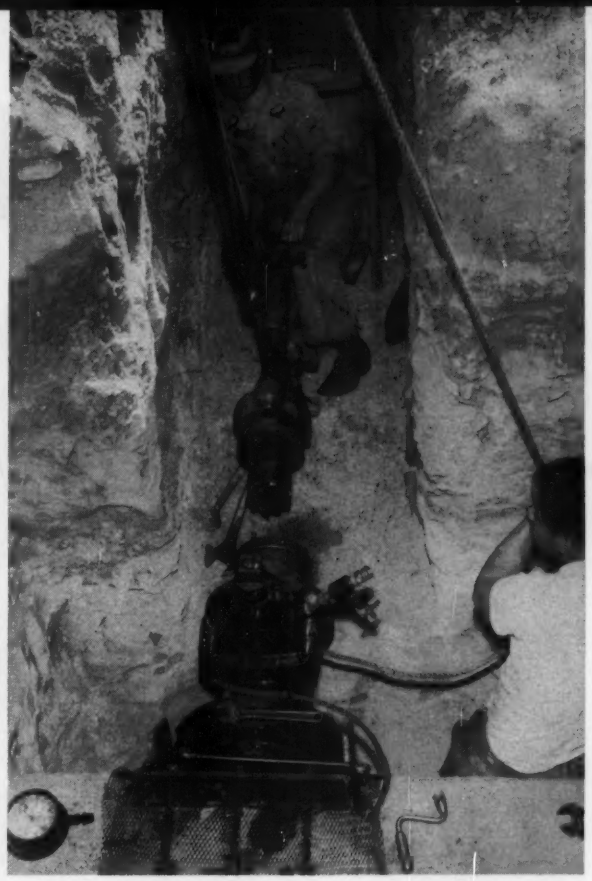
GALION
ESTABLISHED 1907

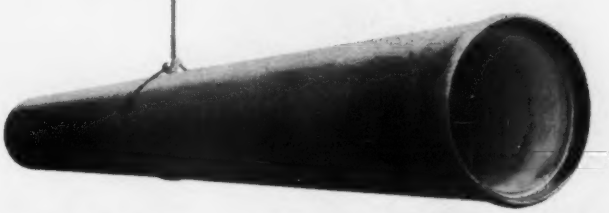


**MOTOR GRADERS & ROLLERS**

# Tapping Water Lines Under Pressure

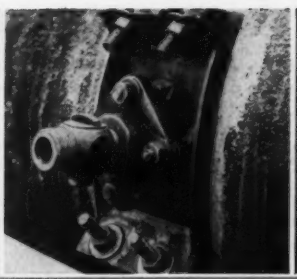
*American Concrete Cylinder Pipe can be tapped with ease and economy while still under pressure.*





The sudden explosive growth of many communities in the west has made it difficult for the best of advance planners to achieve both economy and adequate service in water supply systems designed for the future.

The possibility of unpredictable requirements for service outlets was one of the factors taken into consideration in the design of American Concrete Cylinder Pipe. Without de-watering the pipeline, small or large diameter outlets can be easily installed by any water works service group using standard tapping equipment. New outlying areas which mushroom in the typical western growth pattern can be readily integrated into a planned system if American Concrete Cylinder Pipe is used for the transmission lines.



American PIPE AND CONSTRUCTION CO.

LOS ANGELES: 4635 Firestone Blvd., South Gate, Calif. LOrain 4-2511
HAYWARD: P.O. Box 630—JEfferson 7-2072
SAN DIEGO: P.O. Box 13—CYpress 6-6166
PORTLAND: 518 N. E. Columbia Blvd.—BUtler 5-2531
ALBUQUERQUE: P.O. Box 1782—CHapel 7-0486
PHOENIX: American Concrete Pipe Co. (Subsidiary) P.O. Box 12127—ALpine 2-7566

CONCRETE PIPE FOR MAIN WATER SUPPLY LINES, STORM AND SANITARY SEWERS, SUBAQUEOUS LINES

## HERE'S WHY THE BORDEN LABEL MEANS A BETTER JOB . . .

**You cut installation cost . . .** Borden Checking Service insures correct dimensions, fit and placement—each panel checked for size, each panel marked, and entire platform is laid out on our shop floor and checked against the shop drawing.

**Level, even surfaces . . .** Floor gratings and safety steps by Borden insure easy working, walking and wheeling surfaces because our precision manufacturing processes require finest quality materials and workmanship.

**Free from warps or camber . . .** Factory tested and inspected, Borden gratings stay perfect through the uniformity of materials and design. No imperfections or irregularities of construction to cause warping or camber, trouble-free service assured for the life of the gratings.

Write today for free 16-page catalog showing all basic types of grating; more than 30 dimensional drawings of subtypes; eight safe load tables for steel and aluminum grating.

**BORDEN METAL PRODUCTS CO.**

*"greatest name in gratings"*

845 Green Lane Elizabeth 2-6410 Elizabeth, N. J.

*Plants at:* Union, N. J. • Leeds, Ala.
Conroe, Texas • Beeton, Ontario

**BORDEN METAL PRODUCTS CO.**

Gentlemen:

Please send me new 1959 BORDEN Catalog

NAME .....

TITLE .....

COMPANY NAME .....

ST. AND NO. .....

CITY AND STATE .....

CIVIL ENGINEERING, April 1959, Vol. 29, No. 4 • Published monthly by the American Society of Civil Engineers. Publication office Concord, New Hampshire. (Second-class mail privileges authorized at Concord, New Hampshire.)

# CIVIL ENGINEERING

APRIL 1959
VOL. 29 NO. 4

*THE MAGAZINE OF ENGINEERED CONSTRUCTION*



*Editor* • Hal W. Hunt
*Associate Editor* • Ruth G. Campbell
*News Editor* • Mary E. Jessup
*Assistant Editor* • Frank J. Schneller, Jr.
*Art and Production* • Dick DiMaggio

*Advertising Manager* • James T. Norton
*Advertising Production* • Alice M. Doerle
*Drafting* • Frank J. Loeffler

**EDITORIAL & ADVERTISING DEPARTMENTS at ASCE Headquarters, 33 West 39th Street, New York 18, N.Y.**

**Advertising Representatives**
*are listed on Index to Advertisers page*

**ASCE BOARD OF DIRECTION**

*President*
Francis S. Friel

*Vice Presidents*
Waldo G. Bowman — Lloyd D. Knapp
Paul L. Holland — Samuel B. Morris

*Directors*
Randle B. Alexander — Earl F. O'Brien
Charles W. Britzius — Wayne G. O'Harra
E. Leland Durkee — Howard F. Peckworth
Weston S. Evans, Sr. — Fred H. Rhodes
Thomas J. Fratar — John E. Rinne
Clinton D. Hanover, Jr. — Philip C. Rutledge
Craig P. Hazelet — Tilton E. Shelburne
William J. Hedley — N. T. Veatch
Finley B. Laverty — D. B. Ventres
Don H. Mattern

*Past Presidents*
Louis R. Howson — Mason G. Lockwood

**EXECUTIVE OFFICERS**
*Executive Secretary* • William H. Wisely
*Assistant Secretary* • E. Lawrence Chandler
*Treasurer* • Charles E. Trout
*Assistant Treasurer* • Enoch R. Needles

The Society is not responsible for any statements made or opinions expressed in its publications.

Subscription Rates—Price 50 cents a copy. $5.00 a year in advance; $4.00 a year to members and to libraries; and $2.50 a year to members of Student Chapters. Canadian postage 75 cents, and postage to all other countries outside of the United States and possessions, $1.50 additional.

Printing—Reprints from this publication may be made on condition that full credit be given to the author, copyright credit to *Civil Engineering*, and that date of original publication be stated.

© Copyright, 1959, by American Society of Civil Engineers. Printed in U.S.A. by Rumford Press.

Member Audit Bureau of Circulations

49,000 copies of this issue printed


## • ARTICLES


*Francis S. Friel* 37 **Journey toward a successful life**
*Boyd C. Ringo* 39 **Solar energy, the solar furnace and the civil engineer**
*Samuel S. Gill* 42 **Legal problems encountered under construction contracts**
*Lee A. Du Bridge* 45 **Great opportunities in civil engineering research**
*Irving B. Rau* 47 **Telephone poles used as piles in New Orleans area**
*George L. Jackson* 50 **Grinding with diamond blades smooths Illinois Tollway**
*William A. O'Leary* 52 **New York sludge goes to sea—or to parks**
*Donald A. Walsh* 56 **What price socialization of engineering?**
*Rolf Schjodt* 58 **Polygonal shape simplifies pipe prestressing**
*E. L. Durkee* 60 **Designing economy into bridge erection**
*Milton B. Meisner* 65 **Performing and interpreting the field density test**
*T. William Lambe* 66 **Sealing the Casagrande piezometer**
*W. W. Moore, Arnold Olitt, Jack Y. Long* 74 **Engineers and unions—California report**


## • SOCIETY NEWS


71 **Cleveland Convention promises memorable program**
72 **Campaign for funds for UEC continues**
78 **Division Doings**
80 **The Younger Viewpoint**
82 **Notes from the Local Sections**
88 **By-Line Washington**


## • NEWS BRIEFS


104 **Construction activity declines in February**
106 **Concrete practices reviewed at ACI convention**
107 **Pipe installed under railroad tracks**


## • DEPARTMENTS


24 News of Engineers
33 Am-Soc Briefs
35 Do You Know That
65 Engineers' Notebook
67 The Readers Write
86 Scheduled ASCE Meetings
107 N. G. Neare's Column
112 Deceased
120 New in Education
122 Non-ASCE Meetings
124 Applications for Membership
124 New Publications
128 Men and Jobs Available
130 Recent Books
132 Catalog Digests
164 Index to Advertisers
**158 Proceedings papers available**

# St. Paul installing 7½ mile steel main

Welding a joint for the coal-tar-enamel coated and wrapped pipe. It is being supplied by Bethlehem Steel in 40-ft lengths. Contractor is Ashbach Construction Co. Consulting engineers: Black & Veatch. St. Paul, Minnesota Board of Water Commissioners: Milton Rosen, President; Leonard N. Thompson, General Manager.

They do things in a big way in St. Paul, Minn. Back in 1920 they embarked on a 5-year, $5½-million waterworks improvement program. In 1958 they began another major project, totalling $2½ million. Tar-enameled steel pipe, 5 ft ID, was selected for both projects.

The old riveted main, approximately 8000 ft long, is still on the job, giving excellent service after 35 years of constant use. The new main, about 41,000 ft long, is of modern welded construction. Even the girth joints are welded, making each portion of the line, in effect, a continuous length of pipe—completely leak-free.

The project, begun in 1958, is scheduled for completion in Fall of 1959, allowing for a shut-down during the winter months.

*Every length of steel pipe is hydrostatically tested in the shop, usually to twice the working pressure, in accordance with AWWA specifications (C-201, Sec. 3-5, 4). And this test is conducted at no extra cost to you!* For more information contact the nearest Bethlehem sales office.

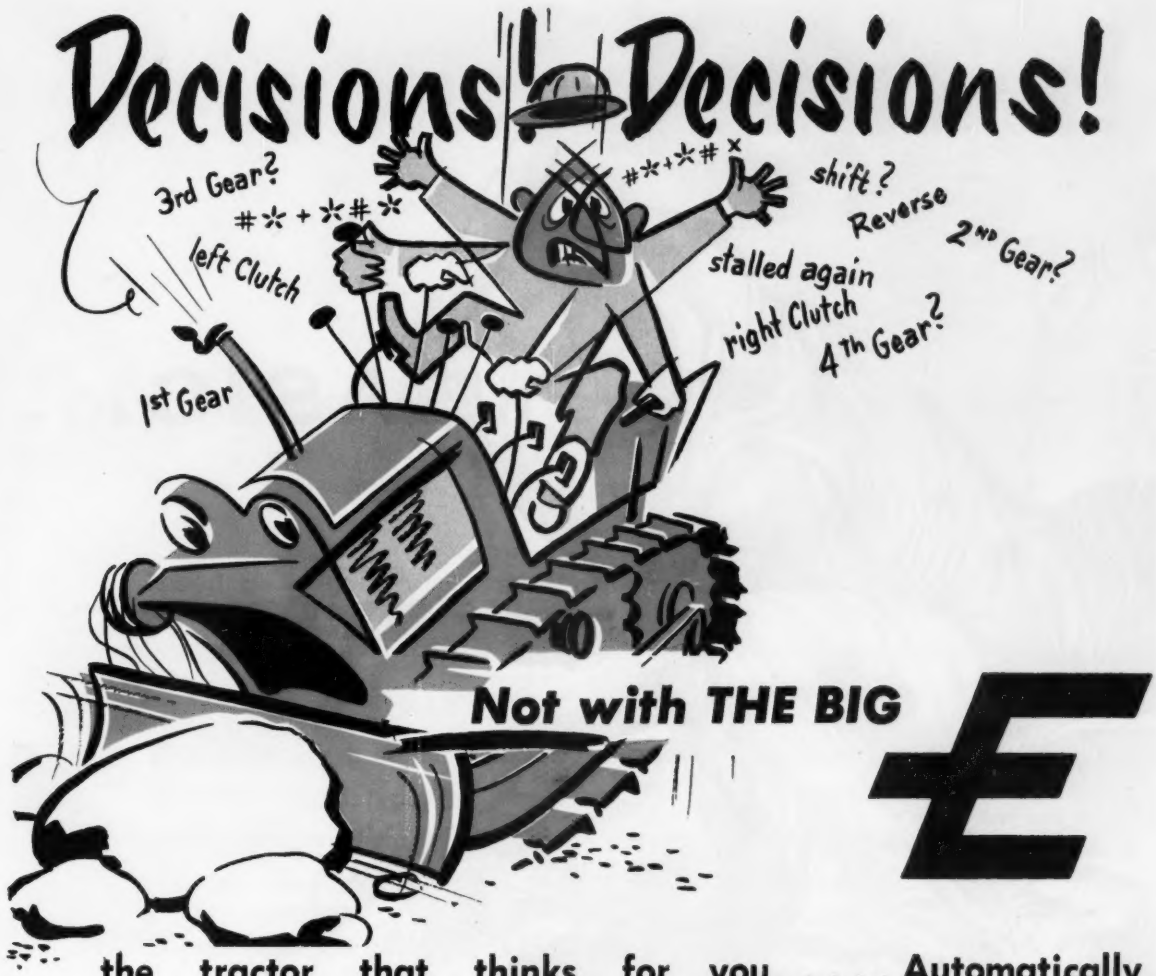
*BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.*

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

**BETHLEHEM STEEL**

BETHLEHEM STEEL

# Decisions! Decisions!




## Not with THE BIG E

**the tractor that thinks for you . . . . Automatically selects the right power ratio for any load or strain!**

Just one of the many job-time and man-hour saving features of the modern Eimco 105 is the exclusive torque converter-Unidrive team, the only drive and transmission that is engineered with oil cooled, positive engagement clutches that never . . . really never . . . need adjustment. No master-clutch to wear out! No clutch pedal to push! No gears to shift!

You get a smooth, powerful drawbar pull or push that adjusts automatically, through an unlimited number of ratios, to the load and strain . . . even if the tractor is at a standstill! The Eimco 105 engine will never stall through the torque converter.

And you get all the other exclusive Eimco 105 features too . . . upfront full visibility operator location; dual final drives that set a new standard in maneuverability; simple controls that increases work efficiency and output.

Let an Eimco sales-engineer demonstrate the many advantages of the modern Eimco 105. Contact the sales office nearest you or The Eimco Corporation, P. O. Box 300, Salt Lake City 10, Utah.

EIMCO

THE EIMCO CORPORATION • SALT LAKE CITY, UTAH

EXPORT OFFICE, 51-52 SOUTH STREET, NEW YORK, N. Y.

BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD

B-380

# BASIC...

**PRIMITIVE WASHDAY**...Washing in a river —inefficient and exhausting—is still done in many undeveloped countries. Clothes never really come clean and are often contaminated.

**THE MODERN WOMAN** merely turns a switch...her wash is done automatically in clear, pure water—most of it carried through cast iron pipe.

**U.S.** cast iron **PIPE**

**FOR WATER, SEWERAGE AND**

**U. S. PIPE AND FOUNDRY COMPANY**

# but better than ever today!

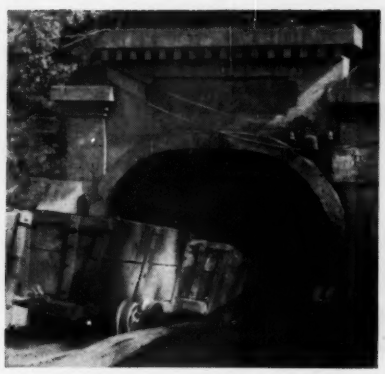
***From mine-to-line, U. S. Pipe controls quality***

America's water systems... finest on earth... didn't just happen.

They are made possible by forward-looking water officials and the dependable cast iron pipe that carries most of the nation's water.

We supply much of that pipe. To make sure it's as good as human care, skill and integrity can make it, U. S. Pipe controls every production step. From mining of ore to modern packaging, our pipe is tested, checked and rechecked for quality every step of the way.

Dependability is built into U. S. Pipe... literally, from the ground up!



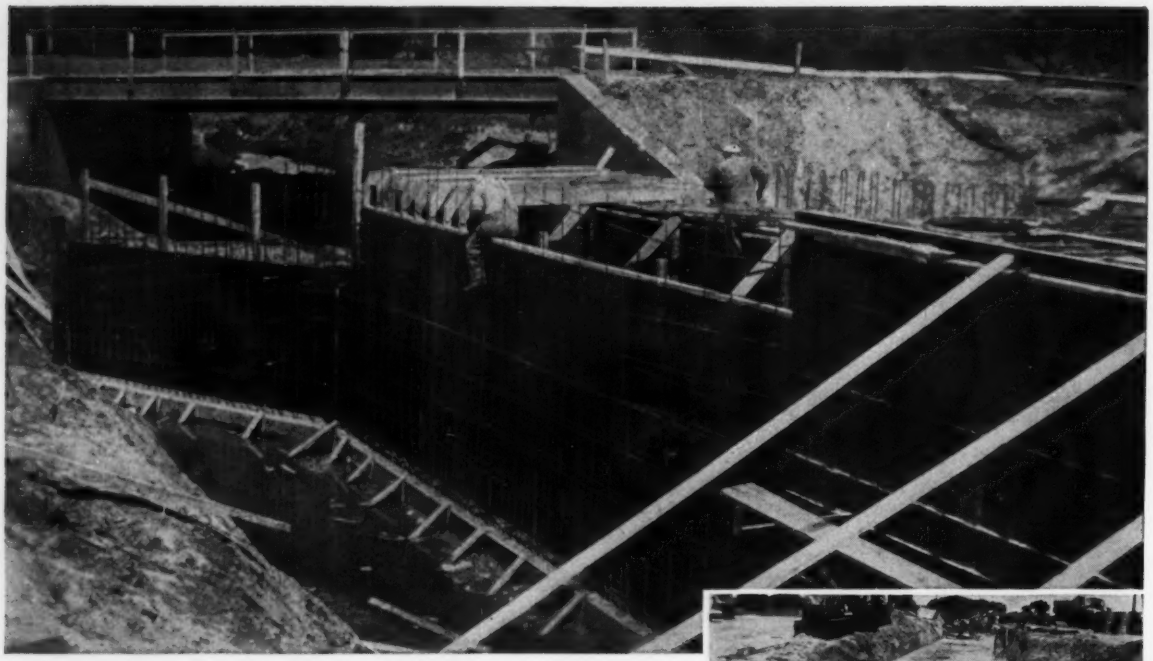
**PROBING THE EARTH** ... Our own iron ore is mined from deposits as much as two miles distant from the portal.

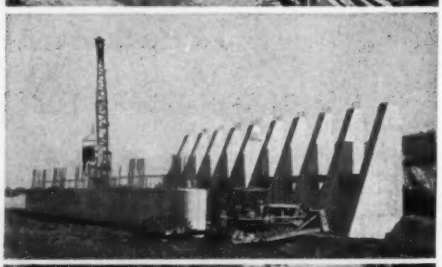
**INSPECTING HOT PIPE**... U. S. Pipe, just removed from the mold, is checked and inspected for quality.

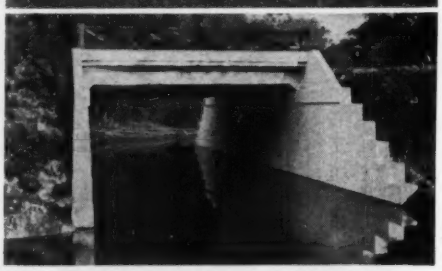
**SCIENTIFIC TESTING**...Determining the chemical properties of U. S. Pipe – one of many quality checks.

**INDUSTRIAL SERVICE** CAST IRON

**Birmingham 2, Ala.** *A wholly integrated producer from mines and blast furnaces to finished pipe.*







## forming Bridges, Culverts, Piers?

# UNI-FORM *PANELS*

## Save LABOR, MATERIAL, TIME!

Simple mechanical assembly and pre-engineered techniques for handling virtually any forming condition make UNI-FORM Panels your best bet for fast, low cost forming. Successful contractors everywhere are using the UNI-FORM system to form bridges, overpasses, culverts, piers and abutments, because their experience has shown that UNI-FORM Panels give them the speed, flexibility and economy required to handle this complex type of forming at the lowest possible cost.

Let us prove our point. Send a set of plans for detailed forming specifications, recommendations and cost analysis. There's no obligation, of course.

P1501

## UNIVERSAL FORM CLAMP CO.

*Concrete Form Specialists Since 1912*

1238 North Kostner Avenue, Chicago 51, Illinois

**BRANCH OFFICES AND WAREHOUSES**

SAN LEANDRO, CAL. 2051-9 Williams Street
LOS ANGELES, CAL. 13210 S. Figueroa Ave.
HOUSTON, TEX. 2314 Preston Ave.
CLEVELAND, OHIO 24901 Lakeland Blvd.
BALTIMORE MD. 1020 N. Kresson St.
ATLANTA, GEORGIA 1401 Howell Mill Rd., N.W.

**Here Are The Basic Elements:**

2. UNI-FORM Tie

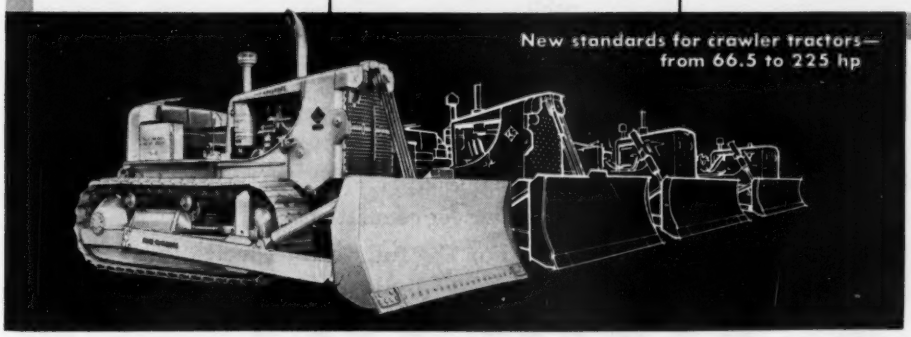
3. UNI-FORM Tie Key

1. Steel framed, plywood faced UNI-FORM Panel

# How to get more tractor for your dollar

**In the chart below are five important crawler tractor advantages. These features have earned recognition by all makers of crawler tractors—one or more are now included in their latest designs. It stands to reason that the more of them you get on your next crawler, the more it is worth to you.**

| Advantage | What it means to you | Where you get it |
|---|---|---|
| All-steel main frames | Power train protection<br>Better equipment mounting<br>Better weight distribution | Allis-Chalmers is the only manufacturer offering main frames in *all* models. Two other manufacturers now offer them in one model. |
| Permanent lubrication of truck wheels, idlers and support rollers | No more wasted time greasing these track components | Allis-Chalmers is the only manufacturer offering permanent lubrication of truck wheels, idlers and support rollers on *all* models. One other manufacturer offers permanent lubrication on three models. |
| Torque converter drive | Matches power to load automatically<br>Transmits power smoothly<br>Less shifting | Allis-Chalmers pioneered it in crawler tractors in 1940 . . . offers it in two tractor shovel models, two tractor models. All other major manufacturers now offer it as optional equipment in one or more models. |
| Double reduction final drives | More clearance<br>Longer gear life | Allis-Chalmers is the only manufacturer offering double reduction final drives on *all* models. One other manufacturer offers it on three models. |
| True unit construction | Faster service<br>Easier access to all major assemblies | Allis-Chalmers is the only manufacturer offering true unit construction in *all* its models. Two other manufacturers now offer modified unit construction in part of their lines. |




**Here's proof that other manufacturers of crawler tractors have chosen to "follow the leader" with Allis-Chalmers engineering . . . and that your Allis-Chalmers dealer is the man to see for top value in crawler tractors.**

**He'll be glad to demonstrate the model of your choice. It will have more industry-approved advantages than any other unit near its size. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.**

**...move ahead with ALLIS-CHALMERS...power for a growing world**

# Always DEPENDABLE For AIR CONTROL Underground

NAYLOR Spiralweld pipe offers practical advantages for ventilating service in tunnel operations.

Its lightweight makes NAYLOR pipe easier to handle and install. The spiral-lockseam adds structural strength and safety, greater resistance to collapse, and permits the use of lighter gauge material without sacrifice of strength.

You save time and work, too, when you use the one-piece NAYLOR Wedgelock coupling for connections.

**For the full details, write for Bulletin No. 59.**

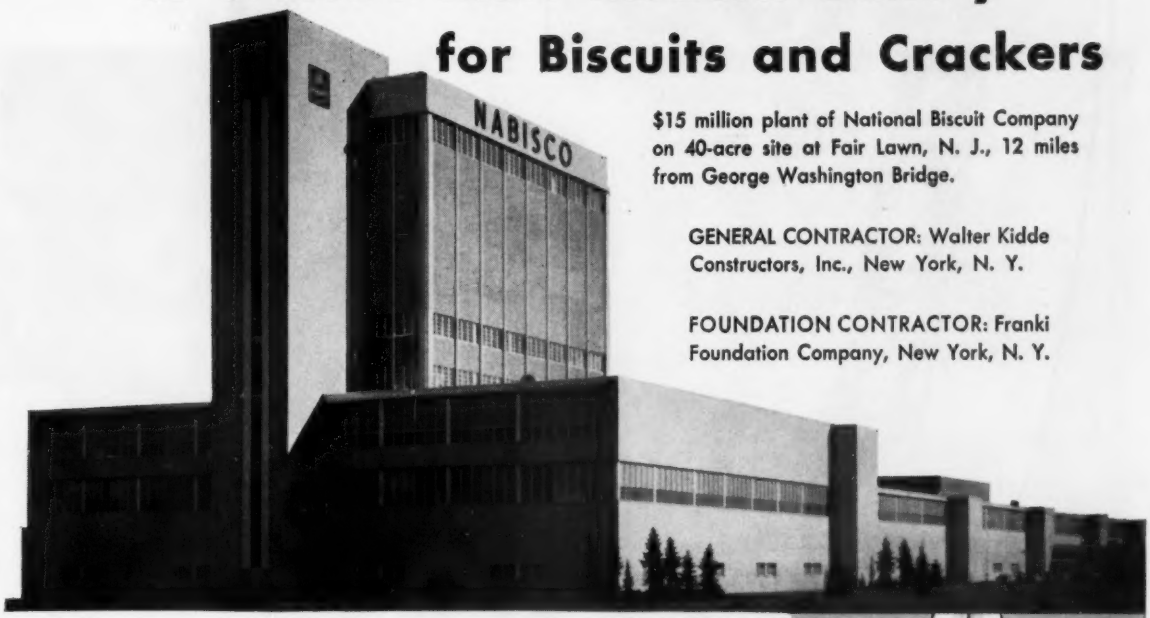
**NAYLOR PIPE** *Company*

1281 East 92nd Street, Chicago 19, Illinois

**Eastern U. S. and Foreign Sales Office:** 60 East 42nd Street, New York 17, N. Y.

# FRANKI FOUNDATIONS

## at World's Most Modern Bakery for Biscuits and Crackers




$15 million plant of National Biscuit Company on 40-acre site at Fair Lawn, N. J., 12 miles from George Washington Bridge.

GENERAL CONTRACTOR: Walter Kidde Constructors, Inc., New York, N. Y.

FOUNDATION CONTRACTOR: Franki Foundation Company, New York, N. Y.

**164-Foot High Tower Section for Raw Materials Storage and also 2-Story Laboratory Built on Franki Displacement Caissons Bearing in Granular Subsoil.**

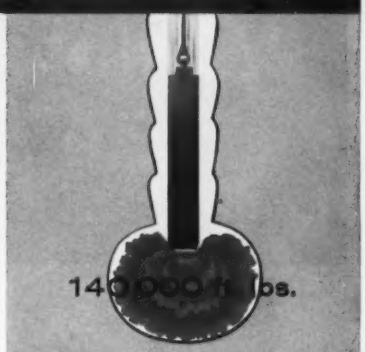
This newest of 10 Nabisco bakeries and a major unit in a $180 million expansion and modernization program was designed and its construction supervised by the Company's own engineering department.

When borings for the tower section at the north end of the plant showed granular subsoil, Nabisco engineers recognized that displacement caissons with expanded base footings would provide a solid and most economical foundation. The tower is primarily for storage of 75 carloads of raw materials with mixing departments in the lower area.

After Franki engineers completed additional soil tests, two rigs installed 407 Franki Displacement Caissons at depths averaging 20 feet below grade, at a rate of better than 6 per day per rig during 36 driving days of cold December and January weather. Groups of caissons carry column loads as high as 940 tons.

Later, Franki engineers were called in again, this time for the foundations for an adjoining two-story Research and Development Laboratory at the south end of the four-block long bakery. A single rig installed 130 Franki Displacement Caissons in 20 driving days at average driven depths of 21 feet.

These two Nabisco installations, like other Franki work, were quoted on a lump sum basis without qualification or payment for excess footage. All work was guaranteed.




### Advantages of Franki Methods

A Franki Displacement Caisson, with its surrounding compacted earth mass, exploits the maximum bearing capacity of the soil.

Every Franki pressure-injected-type footing of "dry"* concrete is "forged" with 140,000 foot-pound blows of a falling ram, a force many times greater than the blow of a steam or pneumatic hammer.

**As a result, the advantages are:**

1. High unit load capacity due to expanded base made in granular soil.
2. Economy because fewer Franki caissons of shorter length are required.
3. Volume of reinforced concrete caps is reduced to a minimum with corresponding savings in cap excavation, sheeting, reinforcing, forms and backfill.
4. Concreting of shaft can be made at any cutoff elevation below grade. Installation can be made in advance of general excavation with resulting saving in sheeting, bracing and maintenance. Depending on water table elevation, economies in pumping costs may also result.

*"Dry" concrete is defined as zero slump concrete using approximately 3½ gallons of water per bag of cement.

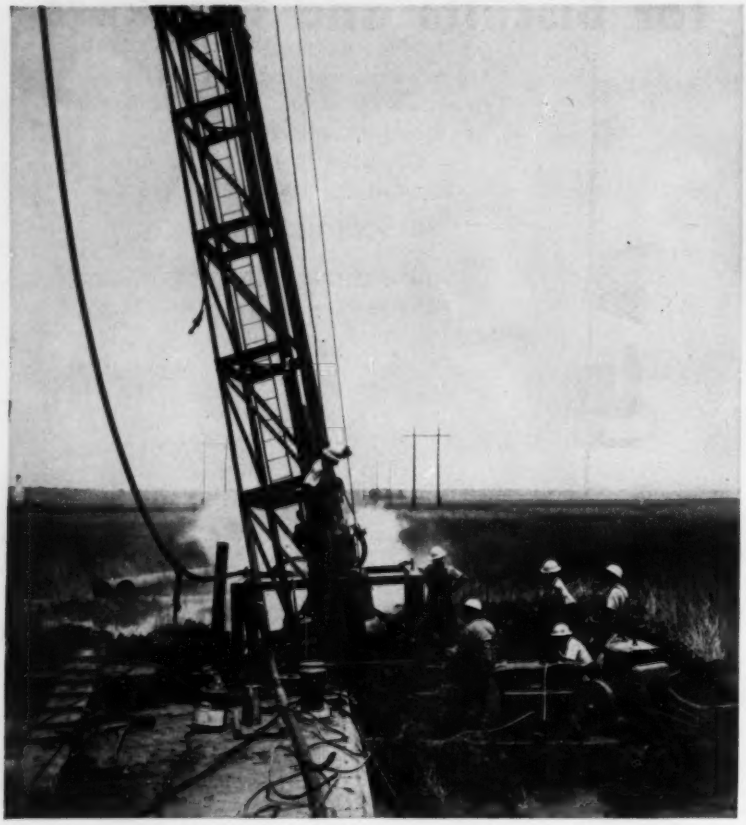
*Consult Franki engineers on your foundation problems.*

## FRANKI FOUNDATION COMPANY

**Displacement Caissons • Pressure Injected Footings • Tube Piles • Underpinning • Soil Investigations**

| 103 Park Avenue | 114 South Warren Street | Statler Building |
|---|---|---|
| NEW YORK 17, N. Y. | SYRACUSE 2, N. Y. | BOSTON 16, MASS. |
| MUrray Hill 5-8916 | HArrison 2-0478 | HAncock 6-0010 |

# Armco Foundation Piles Support Steel Towers in River Delta Area

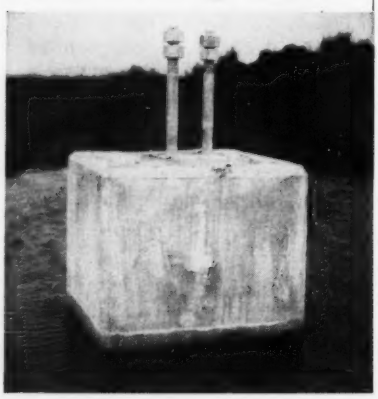


Two of the four Armco Piles can be seen inside this dewatered concrete form. Reinforced rod cages will be inserted in the piles before pouring concrete.

Driving Armco Foundation Piles on a batter, from a barge. Four piles support each pier. Four piers were required for each of the 14 towers.

**Engineers:** Southern Services, Inc., Birmingham, Alabama
**Driving Contractors:** Bernard & Byrd, Mobile, Alabama

Close-up of one completed pier of the tower base that encloses four Armco Piles. Tower will be attached to large bolts.



Because of increased demand for electricity in northwest Florida, the Gulf Power Company of Pensacola needed an additional transmission line across two miles of the Escambia River's delta. One of the problems was to provide stable footing for 14 new steel towers, each more than 100 feet high. Armco Foundation Piles helped provide this solution.

Because of the marshy area, the pile driver had to be mounted on a barge. And since piles were designed to be driven on a batter, a special pile template was used to guide and simplify driving. Next, a cofferdam was built around the pier. Then, reinforcing rod cages were dropped to the full length of the piling. Finally, concrete was poured, embedding two large bolts for attachment of the tower leg.

Most of the Armco Piling was 20-inch O.D., driven to an average depth of 46 feet to obtain the 30-ton loading. Piles driven totalled 9,420 feet.

Consider Armco Foundation Piles for *your* next job. Write us for data. Armco Drainage & Metal Products, Inc., 5129 Curtis Street, Middletown, Ohio. In Canada: Guelph, Ontario.

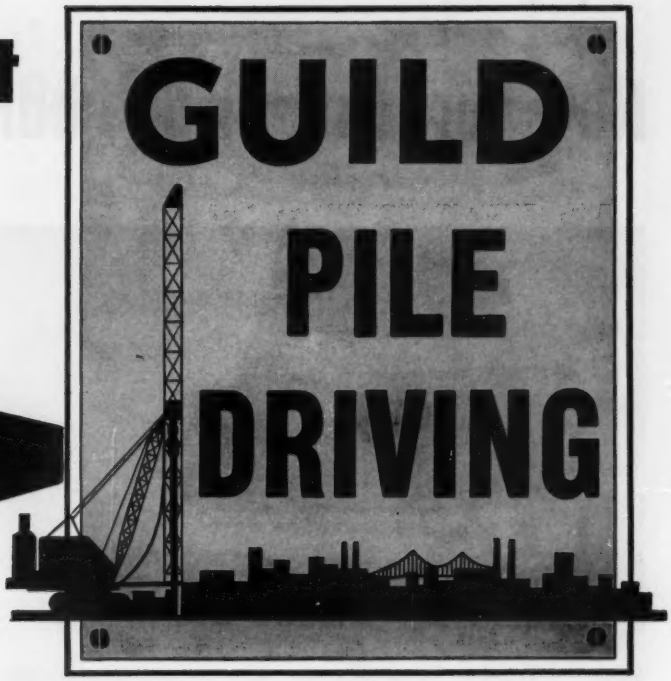
## ARMCO DRAINAGE & METAL PRODUCTS

*Subsidiary of* ARMCO STEEL CORPORATION

OTHER SUBSIDIARIES AND DIVISIONS: Armco Division • Sheffield Division • The National Supply Company
The Armco International Corporation • Union Wire Rope Corporation • Southwest Steel Products

# Throughout the Country

## THIS SIGN...




## *Stands for the Best Pile Driving on the Biggest Jobs*

NO matter where you go in the United States you'll note more and more structures are being built on firm-anchored Cobi Piles driven by C. L. Guild Construction Co., Inc., specialists in the use of Cobi Piles. There are many, many technical reasons for specifying Cobi Piles by Guild for any type of structure. And there are many, many good business reasons too, since Cobi Pile economy has been proven on hundreds of buildings, piers, and bridges throughout the country.

*SPECIALISTS*

IN THE USE OF COBI PILES

*Call C. L. Guild for estimates on any type of piling job anywhere in the country.*

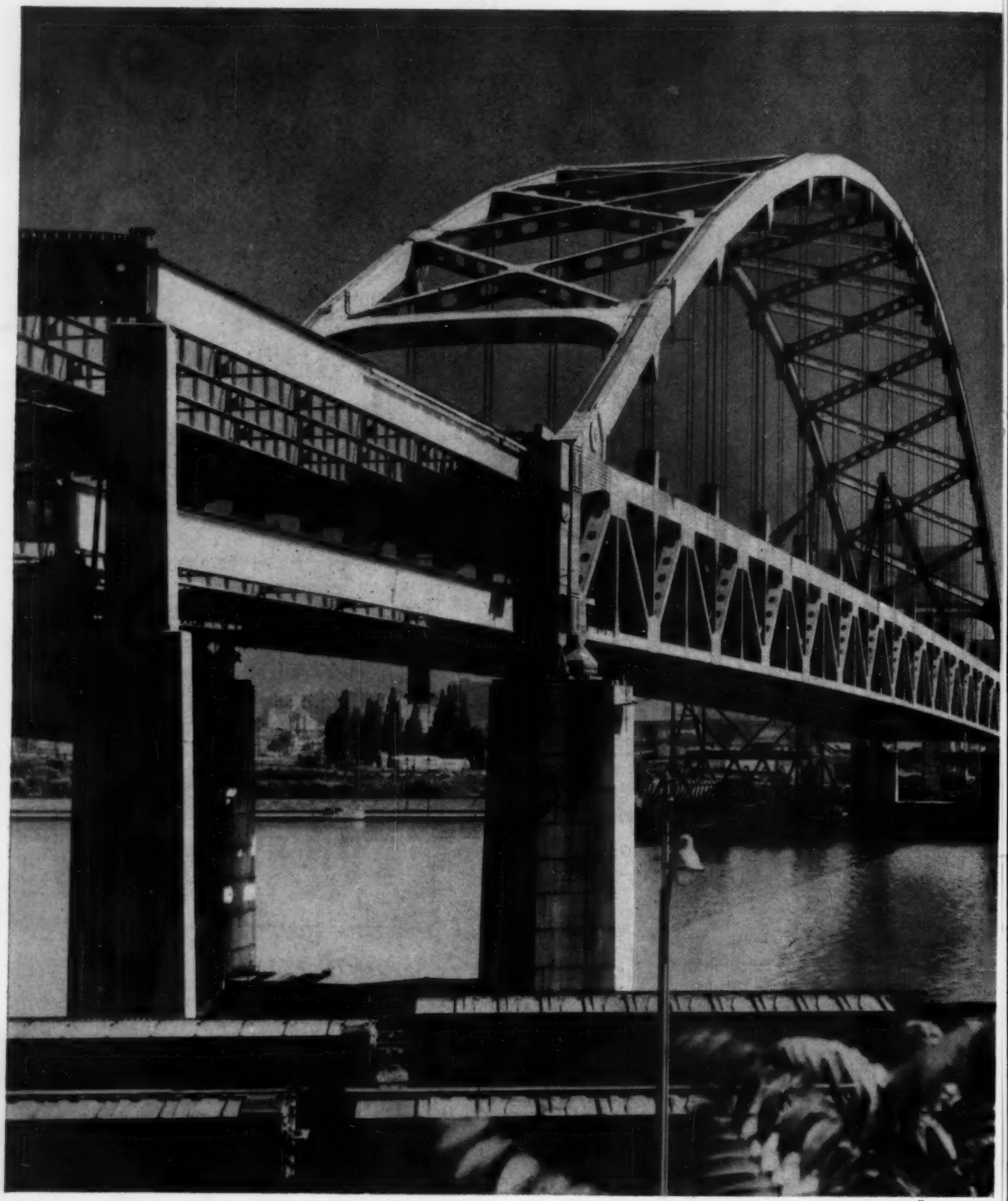
**C. L. GUILD CONSTRUCTION CO., INC.**

90 Water Street, East Providence 14, R. I.

BOSTON, MASS. WASHINGTON, D. C. HOUSTON, TEXAS
SYRACUSE, NEW YORK ATLANTA, GEORGIA KANSAS CITY, MO.

Only span of its kind in the world . . .

# New Fort Pitt Bridge built with cost-saving



# USS MAN-TEN High-Strength Steel

Under the shiny new paint on Pittsburgh's Fort Pitt Bridge is a steel with a reputation—USS MAN-TEN High-Strength Steel. More than two-thirds of the 8,000 tons of steel used in the 750-foot span is USS MAN-TEN brand —a steel that delivers high strength (50,000 psi min. yield point) with economy.

The bridge is regarded by engineers as the most unusual structure in the entire Penn-Lincoln Parkway System. It is a double-deck, tied-arch design and will carry four lanes of one-way traffic on each level.

For the heavily stressed members, high-strength steel answered the problem of getting higher allowable stress per dollar by avoiding unnecessary weight. USS MAN-TEN Steel was used in all chords, most diagonals and verticals, and all portal members including end floor beams. The roadways are supported by 112 pre-stressed USS Tiger Brand suspender ropes, each 3¼" in diameter with an ultimate strength of 475 tons.

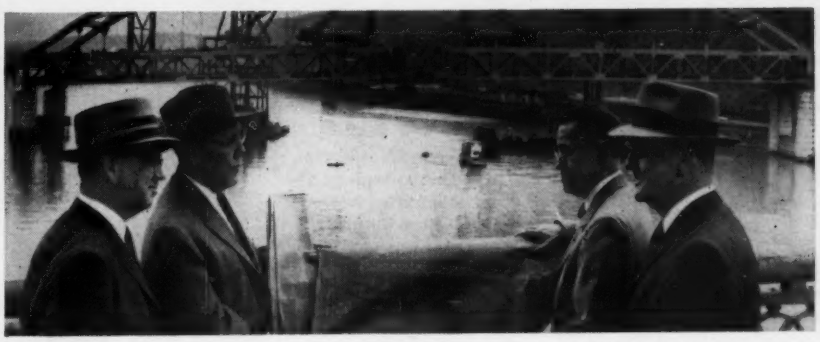
**Other USS High-Strength Steels available** for construction include USS TRI-TEN High-Strength Low-Alloy Steel which, like USS MAN-TEN, has a minimum yield point of 50,000 psi and which is particularly recommended for welded structures. USS COR-TEN High-Strength Low-Alloy Steel also has a 50,000 psi minimum yield point and, because of its outstanding resistance to atmospheric corrosion and superior paint adherence qualities, is a "natural" for riveted structures located in corrosive areas. Where an extra high yield strength steel is needed, we offer USS "T-1" Constructional Alloy Steel which combines weldability and toughness with 100,000 psi minimum yield strength.

For complete information on any of these steels, write United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

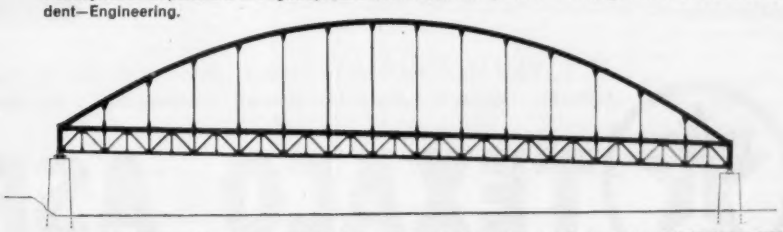
*USS, MAN-TEN, COR-TEN, TRI-TEN, "T-1" and TIGER BRAND are registered trademarks*

**United States Steel Corporation—Pittsburgh**
**American Steel & Wire—Cleveland**
**Columbia-Geneva Steel—San Francisco**
**Tennessee Coal & Iron—Fairfield, Alabama**
**United States Steel Supply—Steel Service Centers**
**United States Steel Export Company**

**United States Steel**



**Some of the men who played major roles** in making the new Fort Pitt Bridge at Pittsburgh a reality: left to right are Alan A. Porter, American Bridge Division's Vice President—Construction; George S. Richardson, consulting engineer, designer of the bridge; Leonard J. Curran, District Engineer, Pennsylvania Department of Highways; and Arthur S. Marvin, American Bridge Division's Vice President—Engineering.



**Where high-strength steel saves money.** Profile of bridge showing parts made of USS MAN-TEN Steel in heavy lines. For these members, MAN-TEN Steel's high strength and relatively low cost made it the economical steel to use.

# Asphalt overlay
## *for busy truck route*

US Route 75 in Texas received hot-mix Texaco Asphaltic Concrete overlay, constructed by the Gulf Bitulithic Company.

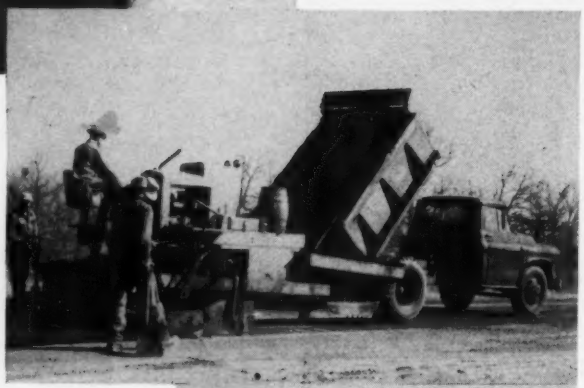
Another section of US 75, which was given a Texaco Asphaltic Concrete overlay by the Public Construction Company.

US 75 is one of the principal trucking routes of Texas. It connects the State's two largest cities, Houston and Dallas.

Last year, two Texas contractors teamed up to construct an overlay of heavy-duty hot-mix Texaco Asphaltic Concrete pavement by a "pave and skip" method on a 30-mile section of this important route. Portions of the existing pavement in satisfactory condition were not overlaid.

Road builders have found the answers to their paving and maintenance problems in Texaco Asphalt products for 55 years. These asphalt cements, cutback asphalts, slow-curing asphaltic oils and emulsified asphalts are produced from scientifically selected crudes. They are refined not merely to meet specifications, but to deliver lasting service with a minimum of maintenance.

Helpful information for the road builder on all types of Asphalt construction is supplied in two free Texaco brochures. Write our nearest office for copies. No obligation.



An 8-ton tandem roller gives final compaction to Texaco Asphaltic Concrete.

THE TEXAS COMPANY, Asphalt Sales Div., 135 E. 42nd Street, New York City 17

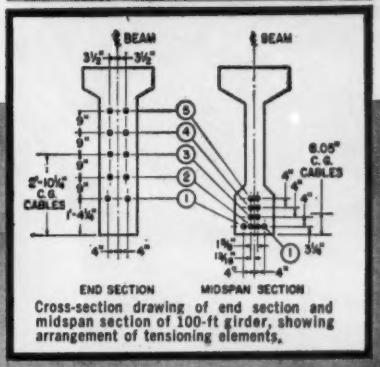
Boston 16 • Chicago 4 • Denver 1 • Houston 1 • Jacksonville 1 • Minneapolis 3 • Philadelphia 2 • Richmond 11

TEXACO

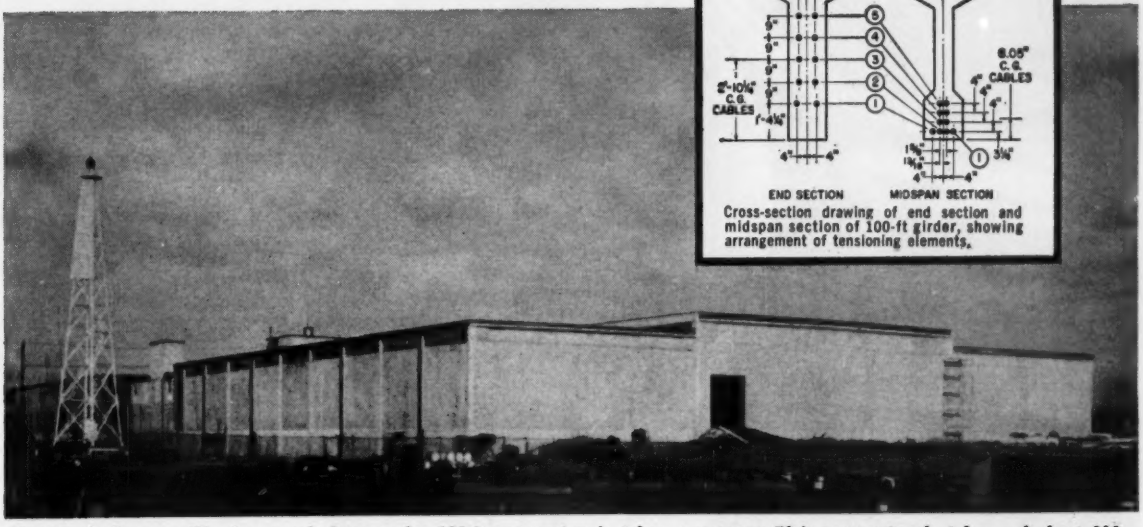
**TEXACO ASPHALT**

# Architect-Engineer offers some impressive reasons why his firm chose Prestressed Concrete for Paper Storage Warehouse

Photo shows how 100-ft girder rests on column. End of 70-ft girder is positioned on seat seen at top of ladder, left.




Cross-section drawing of end section and midspan section of 100-ft girder, showing arrangement of tensioning elements.



*Newman & Company Warehouse, embodying twelve 100-ft post-tensioned girders, twenty-two 70-ft post-tensioned girders and about 600 pre-tensioned double tee beams.*
*Architects and Engineers: Cronheim & Weger, Philadelphia, Pa. Contractor: Lauter Construction Company, Philadelphia, Pa.*
*Prestressed Fabricators: Atlantic Prestressed Concrete Co., Trenton, New Jersey.*

Because Nathan Cronheim, architect-engineer, has much to say about this structure, we quote him as follows: "The design of the new waste paper storage building for Newman & Company, Inc., manufacturers of paper board in Philadelphia, incorporates a number of relatively new techniques and processes in developing a more fire-resistant building and in expediting the handling of stored materials.

"The roof structure is composed of twelve 100-ft span and twenty-two 70-ft span post-tensioned girders. Each girder was post-tensioned with ten Freyssinet Cables composed of twelve .276" diameter Roebling wires. (See diagram). The approximately 600 double T's used in the roof structure are pre-tensioned, using the Roebling standard seven wire pre-tensioning strand. The great strengths resulting from this method allow the roof structure to be much shallower and lighter in weight than would be possible in other types of equally fire-resistant construction.

"The building is two hundred and forty-ft wide, made up of a center bay one hundred-ft wide and two side bays each seventy-ft wide. There are, therefore, girders one hundred-ft long in the center bay flanked on either side with girders seventy-ft long. Since the girders are spaced twenty-five ft on centers, the T's which span from girder to girder are almost twenty-five ft in length. As can be readily seen, due to the exceptionally long spans, it is necessary to use the higher strength materials mentioned to keep the dead weight of the roof structure to a minimum.

"Because of the prefabrication of so many of the elements of this building, such as the girders, roof plank, wall panels and many of the columns, the erection of the building moved very rapidly once the foundation work was completed."

Nothing makes a better case for the prestressed concrete method than the *architect's own words.* In all of the many years that Roebling has concerned itself with tensioning elements for prestressed concrete, we have found that its inherent benefits are best articulated by the architects and engineers who design for, and work with, prestressed concrete. During these years we have developed and accumulated a significant body of knowledge, data and experience that **we** will gladly share with you. An inquiry to Construction Materials Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey, bearing on any phase of prestressed concrete, will bring a prompt and fully documented reply.

**ROEBLING**

*Branch Offices in Principal Cities*
*Subsidiary of The Colorado Fuel and Iron Corporation*

*"Traffic-go-round" Texas-style!*

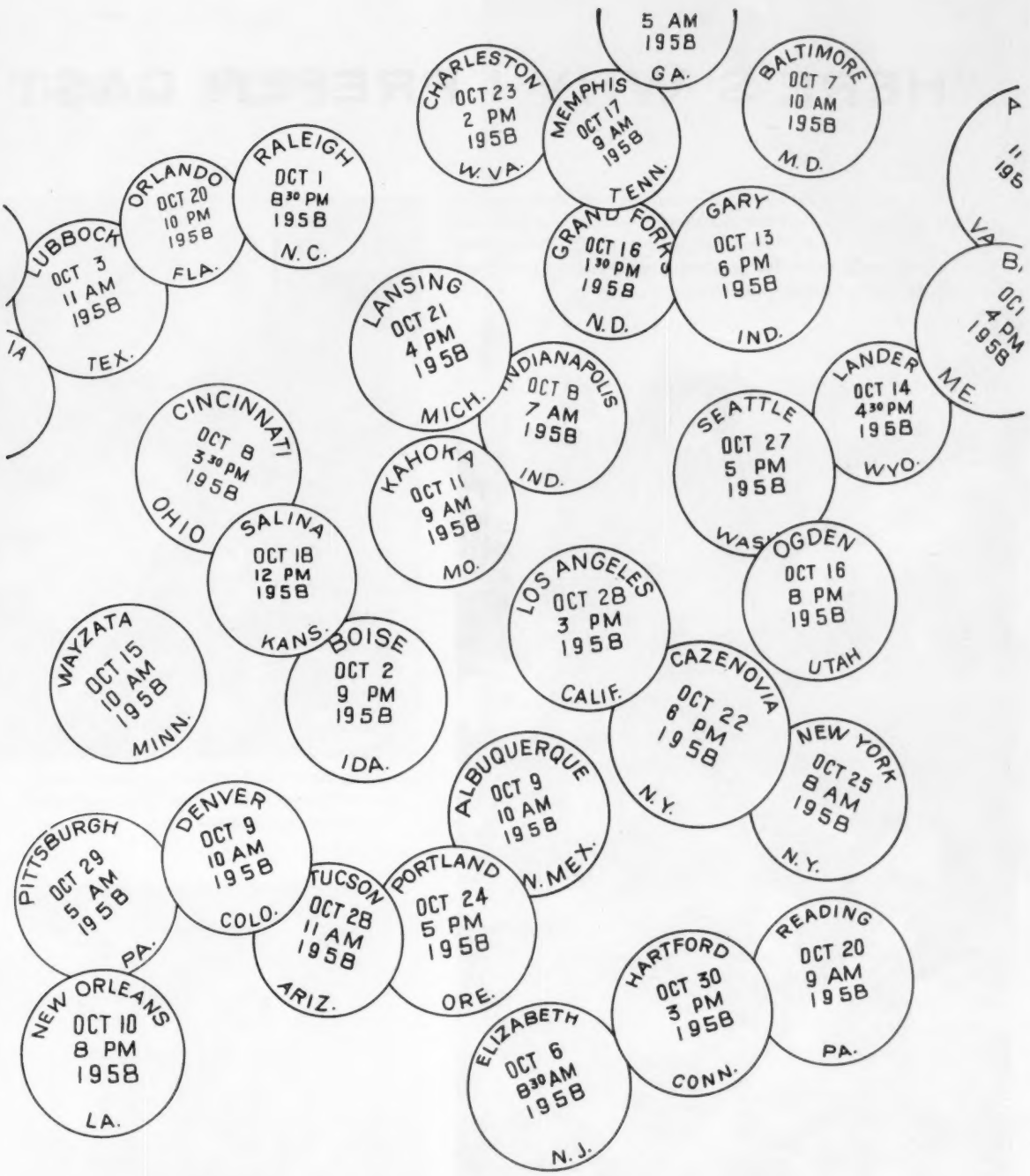
# Reinforced CONCRETE

## *Four-Level Interchange at Fort Worth . . .*

Just imagine designing this four-level interchange in a construction material other than reinforced concrete. Texas highway engineers found reinforced concrete the logical, economical solution. Here the design called for a direct-connect interchange in a restricted right-of-way. They chose the shallowest possible construction . . . continuous reinforced concrete slab. This provided guaranteed minimum over-all height with the required vertical clearance for the lower roadway levels. The design flexibility of reinforced concrete also simplified the forming problems for fitting curves and varying elevations with no complicated shop details. On your next bridge or multiple overpass, design for beauty plus economy . . . and stay on schedule with reinforced concrete.

*CONCRETE REINFORCING STEEL INSTITUTE*
38 South Dearborn Street, Chicago 3, Illinois

Designer: Bridge Section, Fort Worth District, Texas Highway Department
Contractors: Austin Bridge Company, Dallas, and Worth Construction Company, Fort Worth


5 AM 1958 GA.
CHARLESTON OCT 23 2 PM 1958 W. VA.
MEMPHIS OCT 17 9 AM 1958 TENN.
BALTIMORE OCT 7 10 AM 1958 M. D.
RALEIGH OCT 1 8 30 PM 1958 N. C.
ORLANDO OCT 20 10 PM 1958 FLA.
LUBBOCK OCT 3 11 AM 1958 TEX.
GRAND FORKS OCT 16 1 30 PM 1958 N. D.
GARY OCT 13 6 PM 1958 IND.
LANSING OCT 21 4 PM 1958 MICH.
INDIANAPOLIS OCT 8 7 AM 1958 IND.
LANDER OCT 14 4 30 PM 1958 WYO.
CINCINNATI OCT 8 3 30 PM 1958 OHIO
KAHOKA OCT 11 9 AM 1958 MO.
SEATTLE OCT 27 5 PM 1958
SALINA OCT 18 12 PM 1958 KANS.
OGDEN OCT 16 8 PM 1958 UTAH
LOS ANGELES OCT 28 3 PM 1958 CALIF.
WAYZATA OCT 15 10 AM 1958 MINN.
BOISE OCT 2 9 PM 1958 IDA.
CAZENOVIA OCT 22 6 PM 1958 N. Y.
NEW YORK OCT 25 8 AM 1958 N. Y.
ALBUQUERQUE OCT 9 10 AM 1958 N. MEX.
DENVER OCT 9 10 AM 1958 COLO.
PITTSBURGH OCT 29 5 AM 1958 PA.
TUCSON OCT 28 11 AM 1958 ARIZ.
PORTLAND OCT 24 5 PM 1958 ORE.
READING OCT 20 9 AM 1958 PA.
HARTFORD OCT 30 3 PM 1958 CONN.
NEW ORLEANS OCT 10 8 PM 1958 LA.
ELIZABETH OCT 6 8 30 AM 1958 N. J.

# From all over the U. S. A., engineers wrote in to say...

# "HERE'S WHY I PREFER CAST

A country-wide survey of consulting engineers, recently completed, asked this question: *What kind of pipe do you prefer for water distribution, and why?* Of the answers received, by far the greatest number named cast iron! Here are typical comments:

"Adequate factor of safety in practice to resist water hammer, heaving, heavy live loads. Ease of joint connections. Reliability in past service."

—Iowa

"Long service and favorable price of installation with least trouble from breaks and other maintenance problems."

—Virginia

"More satisfactory and tighter connections. Easier to make adjustments if actual measurements and fittings do not correspond with plans or if changes are made along the way."

—Illinois

# IRON PIPE"

"1. Durability. 2. Uniform quality of installation, regardless of contractor's ability."

—Georgia

"Cast iron, being more physically rugged, can be installed with less supervision and less chance of subsequent failure due to improper bedding or loading conditions."

—Massachusetts

**Three reasons why cast iron pipe is America's greatest water carrier:**

1. More miles of underground cast iron water mains are now in use than of all other kinds of pipe combined.

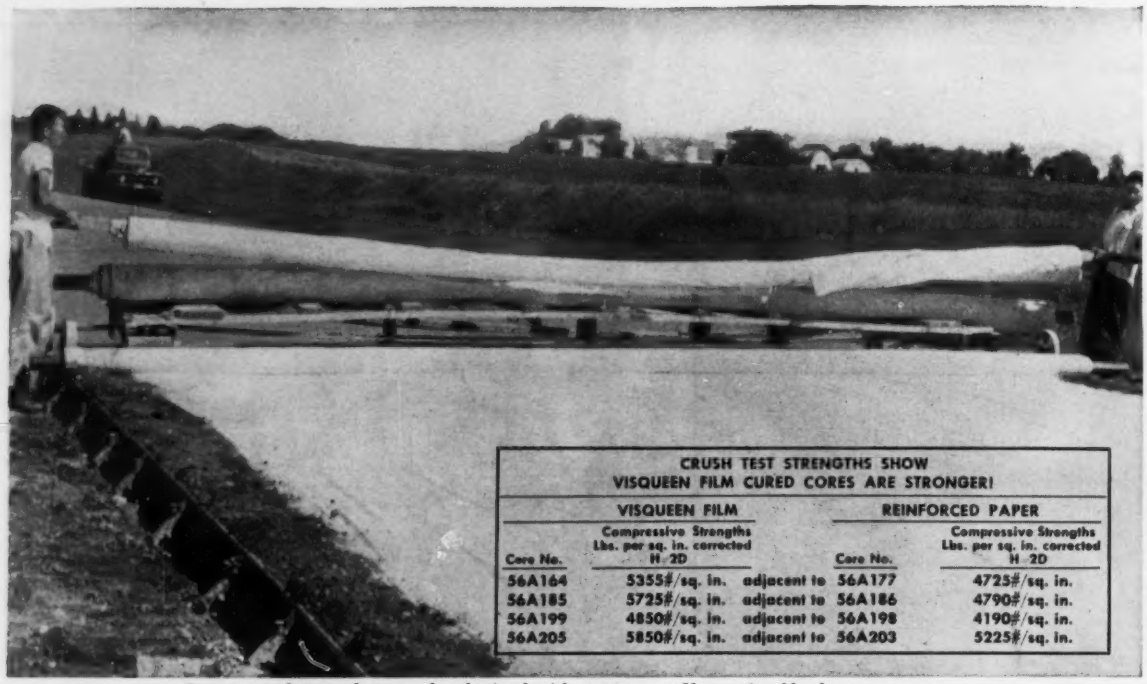
2. More miles of cast iron water mains are now being purchased and laid than of any other kind of pipe.

3. Impartial surveys prove that today's water utility officials and consulting engineers prefer cast iron pipe for underground water distribution by an overwhelming majority.

*. . . good reasons for you to choose*

## CAST IRON PIPE

Cast Iron Pipe Research Association, Thos. F. Wolfe
Managing Director, 3440 Prudential Plaza, Chicago 1, Ill.



**CRUSH TEST STRENGTHS SHOW VISQUEEN FILM CURED CORES ARE STRONGER!**

| VISQUEEN FILM | | | REINFORCED PAPER | |
|---|---|---|---|---|
| Core No. | Compressive Strengths Lbs. per sq. in. corrected H/D | | Core No. | Compressive Strengths Lbs. per sq. in. corrected H/D |
| 56A164 | 5355#/sq. in. | adjacent to | 56A177 | 4725#/sq. in. |
| 56A185 | 5725#/sq. in. | adjacent to | 56A186 | 4790#/sq. in. |
| 56A199 | 4850#/sq. in. | adjacent to | 56A198 | 4190#/sq. in. |
| 56A205 | 5850#/sq. in. | adjacent to | 56A203 | 5225#/sq. in. |

*Core strength tests show results obtained with VISQUEEN film curing blankets.*

# "VISQUEEN" TRADEMARK FILM GIVES STRONGER CURES WITH GREATER ECONOMY

LOW FIRST COST—plus as many as 23 re-uses cut blanket costs to a fraction of a cent/sq. ft.

LOWER LABOR COSTS result because white opaque VISQUEEN film is far lighter, hence easier, more speedily handled. 1000 sq. ft. of .004" thickness weighs 20 lbs. And white opaque VISQUEEN film curing blankets *stay* light. Will not absorb moisture.

TIME SAVING: When using VISQUEEN film curing blankets, additional watering is not necessary. The film rolls up easily—needs no drying or special handling. Will not rot or mildew. Inert—no chemical reactions with concrete—leaves no deposit on slab.

ONLY VISQUEEN film comes in standard widths—or blankets—*seamless* widths up to 32'. Available in 14' roll widths with no folds.

ADDITIONAL USES of VISQUEEN film: rain blankets, equipment and material covers.

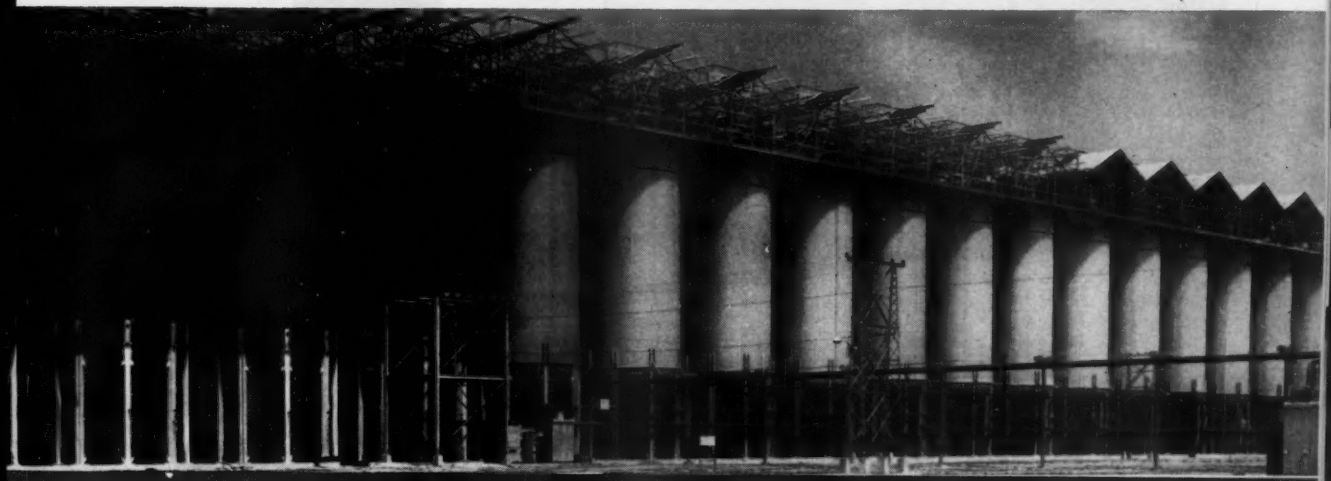
Write now—or use the information request tag below for full information on how VISQUEEN film can do your job better at less cost.

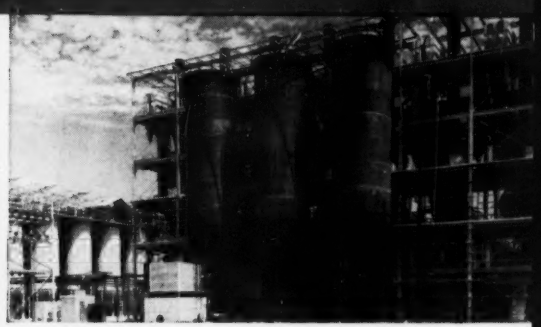
information request tag
VisQueen
Trade Mark
clip this tag—#CV1
attach to letterhead, mail.

**VISQUEEN** *film—first and foremost polyethylene film.*
*A product of the long experience and outstanding research of*
*PLASTICS DIVISION*
**VISKING COMPANY** *Division of* UNION CARBIDE *Corporation.*
*6733 West 65th Street, Chicago 38, Ill.*
*In Canada: VISKING COMPANY DIVISION OF UNION CARBIDE CANADA LIMITED, Lindsay, Ontario.*
*VISQUEEN, VISKING and UNION CARBIDE are registered trademarks of Union Carbide Corporation.*

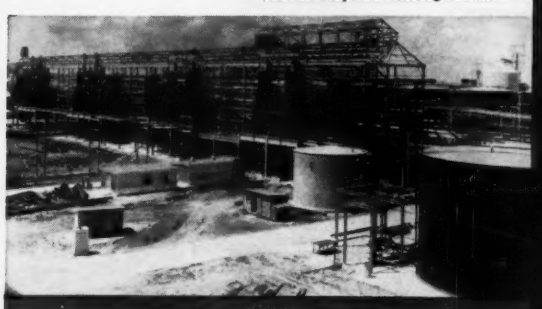
# scope IN PLATE CONSTRUCTION FOR ALCOA AT POINT COMFORT, TEXAS

## BY Pittsburgh-Des Moines

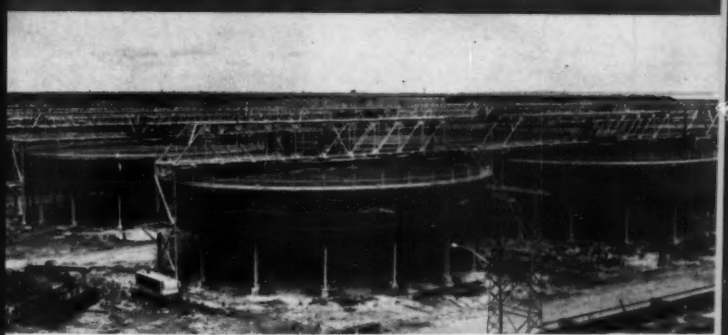




Elevated hydrate storage tanks



**295 process and storage structures,** together with structural housings, totalling approximately 23,000 tons of steel. This project, completed recently by PDM for Aluminum Company of America at Point Comfort, Texas, is yet another impressive indication of PDM's ability to engineer, fabricate and erect the big jobs in steel. 7 fabricating plants to serve you. Consultations promptly arranged. Write.



PDM
STEEL PLATE WORK

**Pittsburgh-Des Moines Steel Company**

Plants at PITTSBURGH, BALTIMORE, DES MOINES, SANTA CLARA, FRESNO, and STOCKTON, CALIF.

*Sales Offices at:*

PITTSBURGH (25).....3470 Neville Island
NEW YORK (17)...Suite 2751, 200 E. 42d St.
CHICAGO (3)..674 First National Bank Bldg.
EL MONTE, CAL.....P. O. Box 2012
ATLANTA (5)...361 E. Paces Ferry Rd., N.E.
DES MOINES (8).....971 Tuttle Street
DALLAS (1).....1275 Praetorian Bldg.
SEATTLE (1).....Suite 378, 500 Wall St.
SANTA CLARA, CAL.....677 Alviso Road
DENVER (2).....323 Railway Exchange Bldg
BALTIMORE (26).....Curtis Bay Station

# NEWS OF ENGINEERS

**Charles B. Molineaux,** vice president and chief engineer of the Arthur A. Johnson Corporation of New York City, received the Public Service award of the Brooklyn Polytechnic Alumni Association on February 5. Mr. Molineaux was chief engineer on the construction of the Quabbin Dike for the Boston water supply system and supervised construction of the Toronto subway and, more recently, the Hudson River bridge at Castleton, N. Y. He is a former Director of ASCE.

C. B. Molineaux

**Morrough P. O'Brien,** Dean of the College of Engineering at the University of California in Berkeley, will retire on June 30. Dean O'Brien joined the Berkeley faculty in 1928, as assistant professor of mechanical engineering. He attained the full professorship in 1936, the chairmanship of mechanical engineering in 1937, and became Dean of the College in 1943. Under his leadership the undergraduate curricula in engineering has been broadened to include more electives in the humanities and social sciences and a program in nuclear engineering has been developed.

**J. A. Donnelly** has been appointed chief engineer of the Fort Pitt Bridge Works, Pittsburgh, Pa. Mr. Donnelly had been plant manager for the structural steel fabricator and erector since 1955, and prior to that was chief draftsman.

**Oren L. Christensen** has taken a position with Lockheed Missiles and Space Division, Palo Alto, Calif., as civil and structural engineer in facilities design. His work will be in planning and designing facilities for Lockheed's missile and space programs. He recently left Earl and Wright, consulting engineers of San Francisco, where he has been a project engineer in structures.

**Reginald J. Sutherland,** formerly airport facilities engineer, has been appointed director, Airport Flight Facility Development, for American Airlines, Inc. In this capacity, Mr. Sutherland will be responsible for the development of airport standards, requirements and facilities for the operation of company aircraft, as well as liaison with the various municipal airport managements and the Federal Aviation Agency.

**John R. Clifton,** Colonel, Corps of Engineers, at the Army Redstone Arsenal in Huntsville, Ala., and deputy chief of the Engineer Office covering Corps of Engineers activities in the Army missile programs, has been designated liaison agent between the Society and the Command. The arrangement, by providing for a single point of contact, is expected to result in greater interchange of information and assistance.

J. R. Clifton

**Charles M. MacWilliam,** structural engineer for the Connecticut Light and Power Company in Waterbury, has been appointed to the newly created position of construction manager. In addition to his present duties, Mr. MacWilliam will supervise all major construction for CL&P handled by contract. Mr. MacWilliam is a member of the Connecticut Water Resources Commission by appointment of Governor Ribicoff.

**Alexander Foster, Jr.,** vice president of Warner Company, Philadelphia, and


...when a city's FIRE PROTECTION rests in your hands...

...depend on GREENBERG–serving industry for 105 years.

Greenberg California Type Fire Hydrants are endorsed by fire chiefs, waterworks superintendents and engineers in the Western States and all temperate climates from Hawaii to Arabia. We also manufacture a complete line of industrial and maritime bronze valves and fittings, plumbing specialties, hose goods, hardware, plaques, tablets and letters.

SPECIFICATIONS

- Fast Breaking Valve Design. Seat angle provides maximum efficiency, minimum resistance, quick opening and full flow of water. Eliminates water hammer and valve chatter at full 200 lbs. working pressure.
- Independent valve for each outlet.
- full 6¼" waterway.
- Curved deflector head – assures full pressure by reducing friction.
- Simple construction. All bronze working parts and heavy cast iron body give long, trouble-free service.

FOUNDED 1854

Approved by Underwriters' Laboratories, Inc., *and The Associated Factory Mutual Fire Insurance Companies.

*No. 74, 75 and 76

Please send for your free copy of our Catalog T.

BRONZE PRODUCTS by M. GREENBERG'S SONS

765 Folsom St. • San Francisco, Calif. • EXbrook 2-3143

Offices in Principal Cities throughout the United States

**Harry F. Thomson,** consulting engineer of St. Louis, Mo., have been awarded honorary life memberships on the Board of Direction of the National Ready Mixed Concrete Association. They received plaques at the organization's February convention in New Orleans. Mr. Thomson is a former Director of ASCE and both are former presidents of the Association.

**Charles D. Curran** has been appointed executive director for the U. S. Study Commission—Texas, with headquarters at Houston, where he is now assembling a staff. The Commission, authorized by Congress last August, was appointed by President Eisenhower in January to prepare a coordinated water plan for eight Texas rivers. Mr. Curran, until recently a consulting engineer in Washington, D. C., was administrator of the Hoover Commission Task Force on Water Resources and Power and, in prior Federal service, was with the House of Representatives Committee on Public Works, the Library of Congress, the Bureau of the Budget, the Corps of Engineers and the U. S.—Mexico International Boundary & Water Commission.

Jackson & Moreland, Inc., announces the following executive promotions: **Frank M. Carhart,** president of Jackson

F. M. Carhart

O. S. Bray

H. B. Perry

& Moreland, Inc. since 1956, is now chairman of the Board, and chairman of the Finance Committee. He joined the firm over thirty-five years ago, and in 1927 became a member of the firm and in 1930 a general partner. **Oscar S. Bray,** formerly project manager, is now president of Jackson & Moreland International, Inc. He joined Jackson & Moreland in 1941 and has been responsible for engineering work on heavy foundations, tunnels, dams, wharves, steam and power plants, sewage disposal systems and a variety of industrial projects. **Horace B. Perry,** a vice president of Jackson & Moreland, Inc. since 1956, has been made a senior vice president. Mr. Perry has been with the firm for thirty-nine years, specializing in the fields of rates, appraisals and associated economic matters.

**Wallace J. Beckman,** sanitary engineer with the Chicago, Ill. firm of Consoer, Townsend and Associates, has been promoted to associate in the firm.

*(Continued on page 26)*

**THE TOP OF ITS CLASS**

**T-16 OPTICAL TRANSIT**

In any comparison of optical and mechanical precision, features and versatility, three characteristics of this repeating transit become immediately evident:

*The Wild T-16 is faster, more accurate, and much easier to work with than any other instrument in its price class.*

This is the consensus of engineers and surveyors in mining, highway and land surveying functions throughout the world.

Your own evaluation, cordially invited, will quickly prove these facts. Write for the WILD Bulletin T-16.

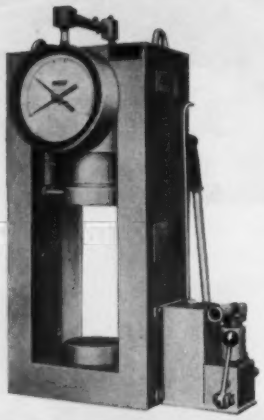
WILD HEERBRUGG

*Full Factory Services*

INSTRUMENTS, INC.

MAIN AT COVERT STREET, PORT WASHINGTON, NEW YORK • PORT WASHINGTON 7-4843

MODEL FT 20
JOBSITE
CONCRETE TESTER



FOR: CYLINDERS, CORES, BLOCKS, BEAMS, CUBES, BRICK AND DRAIN TILE
FORNEY'S INC.
TESTER DIVISION
BOX 310, NEW CASTLE, PA., U.S.A.

TIDE GATES

Figure B-175. Type M-R Gates designed especially for application to centrifugal pump discharge lines. A rubber seating ring is inserted in the seat to absorb the slap which occurs when pumps stop. A flexible bar connection is arranged between the hinge links to provide a stop for the gate shutter to prevent the outer edge of the shutter from tipping downwardly when flow abruptly ceases. Smaller sizes of gate are provided with a bumper arrangement to prevent the shutter being forced too widely open when flow starts.

*Ask for Bulletin 73A*

BROWN & BROWN, INC.
LIMA, OHIO, U. S. A.

## News of Engineers

*(Continued from page 25)*

**J. C. Witt,** Chicago consultant specializing in cement and concrete, has affiliated with Maurice H. Connell and Associates as an associate consulting engineer, but he will continue to operate his Chicago office. Dr. Witt is author of "Portland Cement Technology" and holds a series of patents dealing with the manufacture and use of portland cement.

J. C. Witt

**Charles A. McMahon** has been promoted to chief of the Planning and Engineering Department of the Community Redevelopment Agency in Los Angeles, Calif. Prior to his promotion Mr. McMahon was senior civil engineer.

**Edward J. Kilcawley,** professor and head of the Division of Soil Mechanics and Sanitary Engineering at Rensselaer Polytechnic Institute, has been appointed to the New York State Air Pollution Control Board by Governor Rockefeller. Mr. Kilcawley's appointment is for a term ending July 1, 1962.

**Albert R. Striegl** received the Army decoration for Exceptional Civilian Service at ceremonies held February 20. Mr. Striegl, formerly a top engineer on the staff of the Chicago District and former Milwaukee District of the Army Corps of Engineers and now in private practice, is author of a scientific study of St. Lawrence Seaway and Great Lakes traffic. This study comprises an important part of an exhaustive traffic survey of anticipated future development of Great Lakes ports.

**Joseph P. Collopy** is a partner in the new firm of Sackett & Collopy with offices at Fort Collins, Colo. The firm specializes in drainage, land development, and problems pertaining to irrigation systems including cathodic protection against corrosion.

**Warren E. Wilson** recently resigned as Dean of Pratt Institute's School of Engineering in Brooklyn, N. Y., to accept a post at Harvey Mudd College, Claremont, Calif.

**Robert C. Briggs,** district engineer for the six New England States for The Asphalt Institute, with headquarters at Boston, is leaving the Institute to be president of the newly incorporated Briggs Engineering and Testing Company, Inc. The new firm's office and laboratory will be located at Cohasset, Mass.

R. C. Briggs

**William D. Hatfield,** retired superintendent of the Decatur, Ill., sewage-treatment plant, is the 1959 president of the Federation of Sewage and Industrial Wastes Associations. Dr. Hatfield, who retired as superintendent after thirty-four years service in 1958, is retained as a consultant to the Decatur Sanitary District and is also carrying on other consulting work in the waste-water field. He is holder of the ASCE Thomas Fitch Rowland Prize and the Rudolph Hering Medal, and the Federation's Charles Alvin Emerson Medal.

**Loren W. Olmstead,** Colonel, Corps of Engineers, and Buffalo District Engineer, was honored recently by the Council of Lake Erie Ports at its annual meeting in Buffalo, N. Y., for his role in building the St. Lawrence Seaway.

**Duane P. Smith,** supervising engineer of the Bechtel Corporation, is being transferred from the company's main office in San Francisco to Paris as a permanent assignment.

**C. R. Maierhofer,** who was recently re-elected to a three-year term on the executive committee of the U. S. National Committee of the International Commission on Irrigation and Drainage, has been chosen to serve as its chairman. Mr. Maierhofer is chief of the Office of Drainage and Groundwater Engineering of the Bureau of Reclamation in Denver.

C. R. Maierhofer

**Park H. Martin** is the new Secretary of Highways in the Cabinet of Governor David L. Lawrence of Pennsylvania. A past executive director of the Allegheny Conference on Community Development, he first conceived and planned the new Greater Pittsburgh Airport when director of the County Planning Department. Mr. Martin is an Honorary Member of ASCE.

**John Randall Owen** has been appointed associate editor of The American City. Mr. Owen, a civil engineer, has worked for the New York Times, and for Engineering News-Record as municipal editor. Other Society members of the staff include the editor, **William S. Foster,** and **Elroy F. Spitzer,** the engineering editor.

**Walter F. Winters** has been appointed King County engineer in Seattle, Wash. Mr. Winters is returning to his native state from New York City where he was on the staff of Grad, Urbahn and Seelye working on the design of a large radio telescope for the Navy.

**Rowat-Murray Engineers** have transferred the activities of their Belmond, Iowa, office to their office in the Professional Building at Fort Dodge. The consolidation will enable the firm to expand its facilities.

**Edgar S. Harrison,** chief mechanical and hydraulic engineer for the Georgia Power Company, is the new vice president and chief engineer for Southern Services, Inc., at Birmingham, Ala., a division of the Southern Company. From 1929 until 1939 he was associated with the Tennessee Electric Power Company when he joined the Georgia Power Company.

**Paul W. Allred, Sr.,** concrete engineer with the Aluminum Company of America, at Tallassee, Tenn. is going to Dutch Guiana on a big dam building job. The 165-ft-high dam will supply power for smelting bauxite ore near where it is mined. Mr. Allred recently completed an assignment on Chilhowee Dam built by Alcoa on the Little Tennessee River.

**Roland M. Austin,** county public health engineer for Chautauqua County, with headquarters at Jamestown, N. Y., has been granted the Charles Agar award of the New York Sewage and Industrial Wastes Association for his paper, "A Water Pollution Control Program in a Recreational Watershed."

**H. C. McDonald,** Public Works Director of Napa, Calif., retired March 15, ending sixteen years service to the city. Prior to joining the city engineer's staff in the early 1940's, Mr. McDonald worked on construction of the Milliken pipeline reconstruction, and later on the Conn dam and pipe. During his tenure Napa acquired the Hacienda Water Company system at a cost of more than half a million dollars.

**I. Ellis Behrman,** director of Beth Israel Hospital, Newark, N. J., since 1936, will retire from the post August 1. Mr. Behrman has served in an advisory capacity on engineering matters since construction of the new hospital building in 1928. At the time he took over the hospital directorship, he was superintendent of construction and maintenance at L. Bamberger & Company in Newark.

**Merton C. Collins,** chief of the Planning and Reports Branch of the Corps of Engineers' South Pacific Division, San Francisco, has retired after eighteen years in that office. His home is at 82 Fairview Avenue, Piedmont, Calif.

The University of Michigan School of Public Health conducted a two-day training program on water filtration February 19-20. Society participants in the program included **Leo V. Garrity,** partner, Garrity & Mosher; **J. A. Borchardt,** associate professor of civil engineering at the University; **J. Homer Hayward,** associate engineer, Ayres, Lewis, Norris and May; **Robert L. McNamee,** partner, McNamee, Porter and Seeley; **H. E. Miller,** director of Continued Education at the University's School of Public Health; **George E. Hubbell,** secretary and partner, Hubbell, Roth and Clark, Inc.; **H. E. Hudson, Jr.,** partner, Hazen and Sawyer; and **John R. Baylis,** engineer of water purification, Chicago Department of Water and Sewers.

**Donald O. Covault,** associate professor of civil engineering at Georgia Institute of Technology, recently received his Ph.D. degree from Purdue University. Before going to Georgia Tech in September 1958, Dr. Covault was employed for three years as a research engineer for the Joint Highway Research Project at Purdue. He is the author of several papers concerned with long-range highway planning.

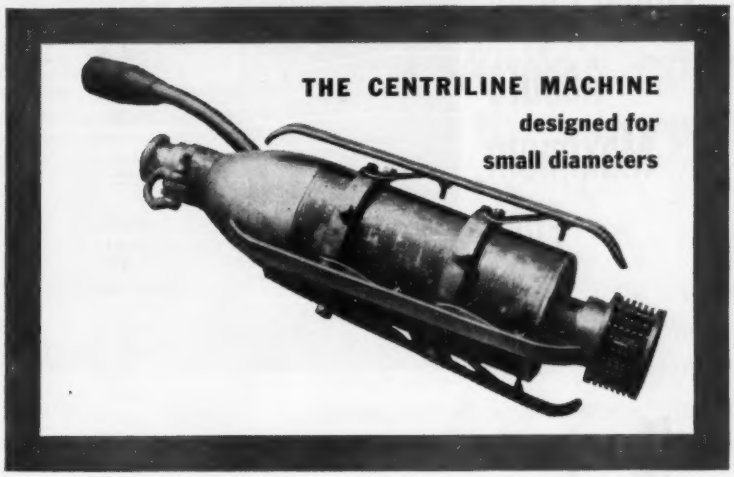
**Hugh A. McKellar,** most recently office engineer with the U. S. Bureau of Reclamation at Provo, Utah, will have charge of the civil engineering offices opened by Louis Berger and Associates in Salt Lake City.

**Edwin H. Webster,** vice president of Whitehead & Kales Company, pioneer Detroit fabricators and erectors of structural steel, was recently elected to the company's Board. Mr. Webster went to the company from Luria Steel of Bethlehem, Pa. in 1956 as assistant manager of the structural division.

E. H. Webster

*(Continued on page 118)*


# NOW! THE CENTRILINE PROCESS is available for 6" to 14" mains, too!




Yes, your city's small but important transmission and distribution lines can also regain their original flow capacity and pressure through the universally accepted Centriline Process of centrifugally applying a cement-mortar coating to the pipe walls. If some of your lines inadequately serve your customers' requirements, including higher demands for fire protection, investigate the numerous advantages of Centrilining your mains now.

The new, small diameter Centriline Machine eliminates most excavations at valves, laterals and corporation cocks. By eliminating these fixed costs, lengthening the distances between access openings and permitting faster lining speeds, the new Centriline Machine has really reduced the cost of lining small mains. So much so, in fact, that every water works operator should reevaluate the economics of small pipe rehabilitation.

*Send today for your copy of our illustrated booklet which fully describes how Centriline can help you salvage worn out pipes from 6" to 144" in diameter permanently and for much less than you would imagine.*

## CENTRILINE CORPORATION

*A Subsidiary of Raymond Concrete Pile Company*

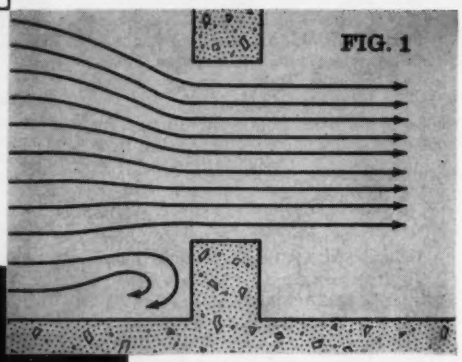
140 Cedar Street
New York 6, N. Y.
WOrth 2-1429

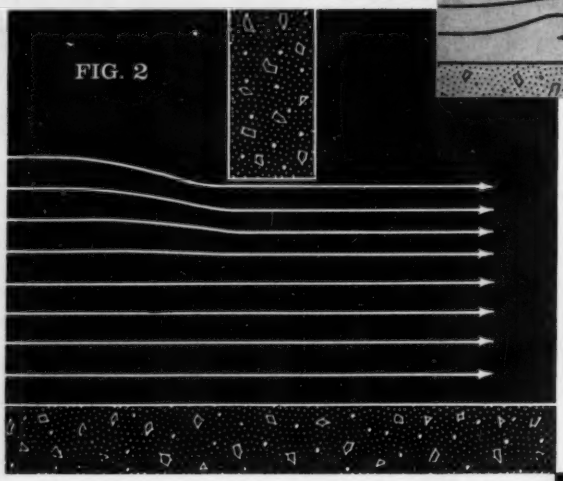
Branch Offices in Principal Cities of the United States, Canada and Latin America.

# SPECIFY RODNEY HUNT
## HY-Q FLUSH-BOTTOM SLUICE GATES
## and get these **6** design advantages

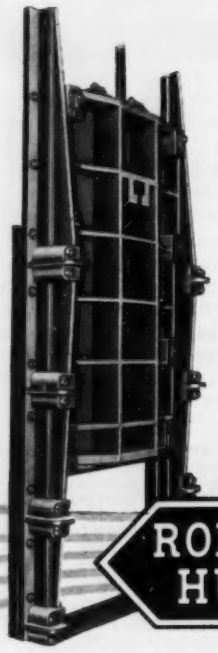
#1

## HY-Q® Sluice Gates Assure Maximum Flow



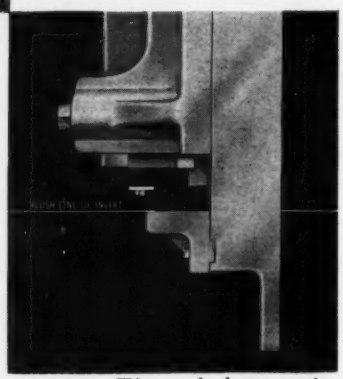




*The vertical wall required with conventional gates (Fig. 1) sets up turbulence and impedes maximum flow when the gate is opened. If mounted with the bottom flush with the invert, the deep pocket required for the bottom wedges creates similar turbulence. The Rodney Hunt HY-Q design (Fig. 2) has neither sill nor pocket to create turbulence. Result — smoothest, highest flow possible. At the bottom of the gate, the HY-Q design provides a flush surface with no impediment to maximum flow.*



The many advantages of the Rodney Hunt HY-Q Sluice Gate derive from the design of the resilient seal fastened to the bottom of the disc as illustrated here. This seal extends the full width of the disc and provides a cushioned closing at the stop bar *flush with the invert.* This flush bottom closure assures—1. maximum flow—2. complete drainage without pumps or piping—3. elimination of silt and debris problems—4. maximum hydraulic gradient—5. lowest possible invert and—6. construction economy.

In brief, the HY-Q design offers unmatched design flexibility and construction economy for water control projects... with hundreds of gate sizes available from 6″ x 6″ to 144″ x 144″ and larger to meet your specific design requirements.



**HY-Q** The sluice gate with flush-bottom closure

RODNEY HUNT

## HY-Q SLUICE GATE
*a product of*
## RODNEY HUNT MACHINE CO.
Water Control Equipment Division
86 Water Street, Orange, Mass.
Serving water control engineers with equipment and engineering

Keep our ROADS on the GO

# Atlas White Cement marks the curve day or night

Reflecting concrete curbing made with Atlas White portland cement marks the road's course—every straightaway, curve and turn—well ahead of the driver. By day, the white surface stands out in contrast to darker road paving. By night, saw-toothed corrugations reflect the car's headlight beams back to the driver for greater visibility. And rainy weather actually heightens the effect; wet curb surfaces become even more reflective.

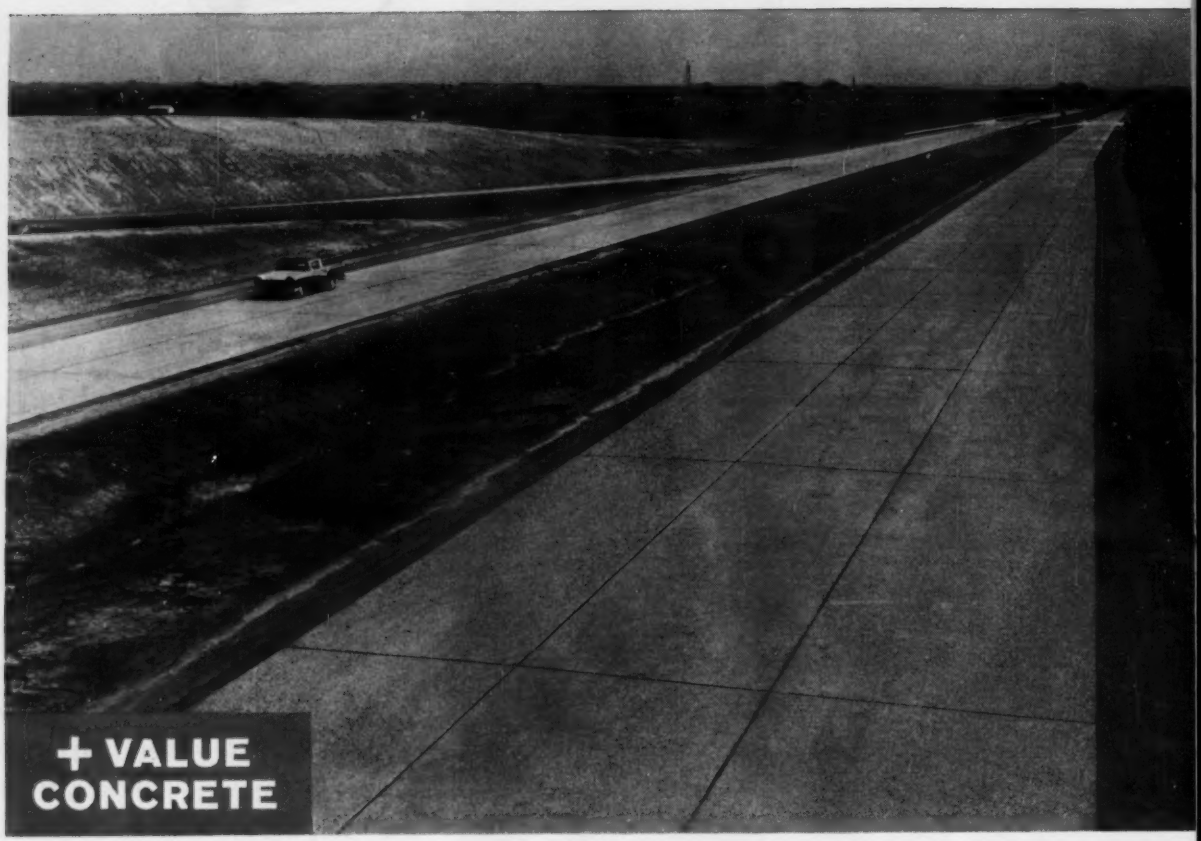
For more information on the use of Atlas White portland cements in highway and street construction, write Universal Atlas, 100 Park Ave., New York 17, N. Y.

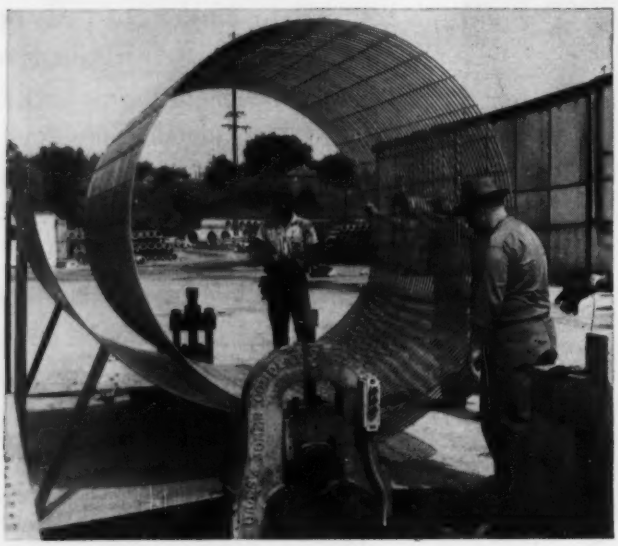
**OFFICES:** Albany • Birmingham • Boston • Chicago Dayton • Kansas City • Milwaukee • Minneapolis New York • Philadelphia • Pittsburgh • St. Louis • Waco

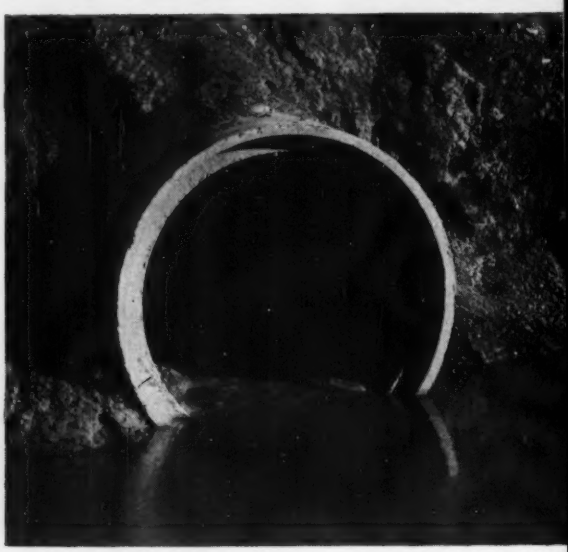
CB-97 "USS" and "Atlas" are registered trademarks

USS **Universal Atlas Cement Division of United States Steel**

# Stronger pavement for





Concrete pipe—reinforced with USS American Welded Wire Fabric—is used throughout the Illinois Tollway. This is permanent pipe, needs no maintenance, and is easy to handle and place. The second illustration here shows the flexibility of USS American Welded Wire Fabric—how easily and completely it conforms to the circular pipe shape.

# the Illinois Tollway

## USS American Welded Wire Fabric Reinforcement

### gives safer, smoother riding surface to 187-mile "short-cut"

The new Illinois Tollway will carry heavy traffic loads in, out and around busy Metropolitan Chicago. It will save time and eliminate traffic bottlenecks on comparatively short trips and will facilitate quick connection with other important highways serving northern Illinois, southern Wisconsin and Indiana.

To protect the $441,000,000 invested in this important highway link, Welded Wire Fabric was used to reinforce the concrete slabs and the concrete pipe. American Steel & Wire supplied the USS American Welded Wire Fabric to assure greater strength, longer life, safer riding surface, freedom from undue maintenance and from unsightly cracks and breaks.

Complete technical information on USS American Welded Wire Fabric is available. Just write to American Steel & Wire, Dept. 910, 614 Superior Avenue, N. W., Cleveland 13, Ohio.

*USS and American are registered trademarks*

**Always ask, "is it Reinforced"**

**American Steel & Wire Division of USS United States Steel**

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors · United States Steel Export Company, Distributors Abroad

*Project:*
Approach ramp to new deck of George Washington Bridge, New York City

*Owner & Engineers:*
The Port of New York Authority

*General Contractor:*
Gull Contracting Co., New York City

# DRILLED-IN CAISSON FOUNDATION
## readily installed through wet silty soil and boulders

Wet running silt and numerous boulders characterized the site of the above-pictured foundation job, awarded to Spencer, White & Prentis. Such difficult soil would have posed problems of great complexity had any other foundation method been used.

With the Drilled-In method, in which this company has long specialized, the necessary 30-inch-diameter caissons were readily carried through obstructions to bedrock at depths up to 54 ft. and were socketed 2 to 8 ft. into the rock.

The operation proved simpler, speedier and more economical than open piers, which had also been specified. On this approach ramp, loads combined with bending forces range from 400 to 1,100 tons per caisson. On other jobs Drilled-In Caissons support up to 1,700 tons each.

**Descriptive literature on request**

FOUNDATIONS
PILING
UNDERPINNING
SHORING
COFFERDAMS
SPECIAL SERVICES

**Spencer, White & Prentis INC.**

10 EAST 40th STREET, NEW YORK 16, N. Y.

DETROIT: 2033 PARK AVE. • CHICAGO: 221 NORTH LaSALLE ST. • WASHINGTON, D. C.: TOWER BLDG.
PITTSBURGH: EMPIRE BLDG. • OF CANADA: 2052 ST. CATHERINE ST. WEST, MONTREAL

# . . . . . *Am-Soc Briefs*

▶ ▶ With the naming of the contractor (the Turner Construction Company) for the United Engineering Center, the new headquarters project takes another step toward reality. . . . Mervin J. Kelly, general chairman of the Industry Gifts Campaign and indefatigable worker in the fund raising, sees the Center as essential to the Societies if they "are to meet their obligations of today and the challenges of tomorrow." Mr. Kelly clearly sets forth the sometimes-overlooked link-up between the profession, the Engineering Societies, and headquarters for the Societies in the UEC article in the Society News section. . . . Industry has now (March 13) pledged 82 percent of its $5,000,000 quota, and member giving is at 71 percent of its $3,000,000 goal.

▶ ▶ Last call for Cleveland. . . . The Cleveland Convention will be here before we know it (May 4–8). The program — printed in the March issue — sounds extremely promising. For engineers interested in the nation's progress in the fields of flight and space travel (and who isn't?), there will be a special Convention dividend in the trip to the Lewis Research Center of the National Aeronautics and Space Administration. It isn't every day that the public gets to visit one of the nation's top research establishments.

▶ ▶ Houston will be another engineers' Mecca this spring, May 20–22, when the Society's second Jet Age Airport Conference meets there, under co-sponsorship of the ASCE Air Transport Division and the Texas Section's Houston Branch. The program is printed in this issue (page 69). . . . As mentioned last month, the May issue of Civil Engineering will be a special Air Transport number with articles by experts in the industry.

▶ ▶ The American Public Works Association has joined ASCE in taking a firm stand in the matter of advertising for bids for engineering services, and the American Water Works Association has announced its intention of following suit. . . . It's good news, too, that three publications — Public Works, Roads and Streets, and American City — have come out editorially against asking for engineering bids.

▶ ▶ Junior Members and students. . . . The Daniel W. Mead 1959 contest for papers on ethics closes May 1. Make your papers good and get them in. . . . There was no Junior Member award in 1958 because the judges felt entries weren't up to scratch.

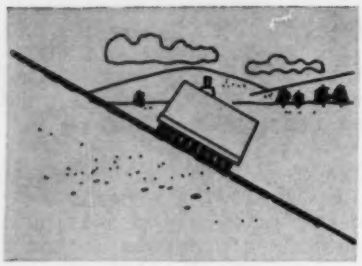
▶ ▶ For eleven years we have been polling our readers — a different 200 of them each month — to find out what is liked and what is not liked in Civil Engineering. Their generous and helpful responses are tallied in Society News.

▶ ▶ While they last. . . . The twenty-five papers presented at the popular Kansas City Conference on Electronic Computation are being offered in a paper-bound volume. The price is $5 to members and $10 to others. The coupon on page 114 will make ordering easy.

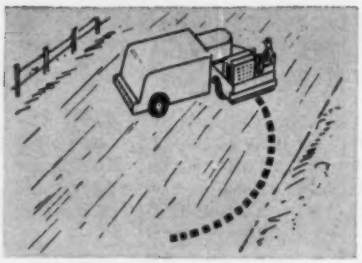
# Let's outlaw tipping

**tipping may be all right in a restaurant . . . or to a red cap but . . .**

tipping is a too frequent operator hazard when you're compacting shoulders. Get a couple of outside wheels in space above a ditch and over goes the roller — and the man. Banish that danger!



The Seaman-Andwall 5620 Pneumatic Compactor is ultra-safe. Its low silhouette and extra width (92″) provide an unusually low center of gravity. It has actually worked day in, day out on slopes as steep as 2 to 1 as illustrated above, without the slightest tendency to tip.



The 5620 is usually maneuverable; turns a full 180° on an 18 foot road. Operator sits sideways to direction of travel, can see his work even in close quarters.

Weight ranges from 7 tons empty to 20 tons with ballast.

**Here's how.** The SEAMAN-ANDWALL 5620 Pneumatic Compactor provides super-safety with an extraordinarily low center of gravity. It has actually worked successfully on a 2 to 1 side-slope (levee construction near Jackson, Mississippi). *No holding cables to a bracing tractor at the top.* The 5620 didn't even slip.

Apart from the safety factor the SEAMAN-ANDWALL 5620 Pneumatic does the job faster with its extra wide rolling width of 92 inches.

And the "straight down" pressure principle provided by front wheel drive eliminates surface shear, scuffing or displacement of materials.

So for operator safety and for faster, lower cost compaction on the level, on steep grades or slopes — this season get yourself the 5620 SEAMAN-ANDWALL 7-20 ton Compactor.

*Send for this illustrated literature with complete specifications on the 5620 Seaman-Andwall Pneumatic Compactor. Just a postcard will bring it promptly.*

7040

## SEAMAN-ANDWALL CORPORATION

*A subsidiary of American-Marietta Company*

**Elm Grove 20, Wisconsin**

# do you know that

**The railroad industry gives signs of picking up?** The New York Central, which bought no freight cars at all in 1958, has ordered 1,000 new hopper cars. The Illinois Central will buy 1,925 new cars, nearly six times as many as last year, and the Rock Island has ordered 700, in sharp contrast to its 100 new cars in 1958. This is especially good news to the rail equipment companies. General Motors, for instance, expects that by June its Electro-Motive Division will be turning out four diesel locomotives a day instead of two as in late 1958.

▪ ▪ ▪

**Something can be done about the weather?** Results of a cloud-seeding program carried out in southeastern Arizona in the summers of 1957 and 1958 prove it, according to the University of Arizona's Institute of Atmospheric Physics. The research program, supported in part by the National Science Foundation, consisted of cloud seeding with silver iodide, at heights of 18,000 to 20,000 ft, on alternate days. Comparisons of precipitation on 32 seeded and 32 unseeded days showed that there was about 30 percent more rainfall on the seeded days. Radar, cloud cameras, and rain gages were used as checks.

▪ ▪ ▪

**As usual the U.S. led the world in road building in 1958?** Total expenditures of $9.93 billion represented a 10 percent increase over 1957. In Europe, a century ago, students of government were freely predicting the demise of the U.S. as a single nation because its transportation system was inadequate to hold such a big country together. Today the U.S. has more highways than any other country, 3,429,801 miles, and the most motor vehicles, 68,398,000.

▪ ▪ ▪

**West Germany was the big surprise in 1958 highway building and spending?** With expenditures of $1,073 million, it for the first time topped Canada as No. 2 road builder. Canada, with outlays of $1,070 million, was in third place. Leading the world in percentage increase in highway expenditures were Venezuela and Denmark—each of them more than doubled its spending on roads in 1958.

▪ ▪ ▪

**Ivy rambling on masonry walls is likely to ruin the buildings?** American ivy, otherwise known as Virginia Creeper or woodbine, contributes significantly to the deterioration of stone and brick structures by inserting filaments between the bricks or stones and encouraging the penetration of water to the interior. These findings are reported by the Brisk Waterproofing Company, which has been restoring the exteriors of famous structures, including historic Monticello.

**About two-thirds of the nation's engineers and scientists are in industry?** As of January 1957 American industry was employing nearly three-quarters of a million engineers and scientists. The total included 528,000 engineers, 152,000 scientists, and 58,000 administrators of scientific and engineering activities. About a third of the group were in research and development work. Industries employing the most engineers and scientists were (in descending order) electrical equipment, aircraft, and chemical and allied products. These data are from a survey of scientific manpower recently completed by the U.S. Bureau of Labor Statistics for the National Science Foundation.

▪ ▪ ▪

**More women must get into engineering and science?** This is the opinion of Arthur S. Flemming, Secretary of Health, Education and Welfare, who feels that women must be more fully utilized in these fields if we are to keep pace with the Soviet Union. Speaking at a recent meeting of the American Association for the Advancement of Science, Mr. Flemming denounced the practice of paying trained women less than men and not employing them at their full potential. Though the United States is second only to Russia in its number of women engineers, its 7,430 women engineers constitute only 1.3 percent of the total holding engineering degrees. Russia has 233,000 women engineers and 449,000 women technicians—respectively 29 and 40 percent of the total holding degrees.

▪ ▪ ▪

**This is the 350th anniversary of Henry Hudson's historic voyage?** In May work will start on the substructure of another bridge across the mighty river bearing the explorer's name. The $40,000,000 suspension span connecting Newburgh and Beacon will replace a ferry chartered by George II in 1743. About $24,000,000 of the cost will be paid by federal aid, the rest by the New York State Bridge Authority. The planned completion date is mid-1962. Modjeski & Masters are the engineering consultants, and Coverdale & Colpitts the traffic engineers.

▪ ▪ ▪

**Interest in electric automobiles is growing?** Rising gasoline costs are stimulating interest in yesterday's battery-powered cars—from Syracuse University research laboratories to a San Diego firm that will begin production this spring. The San Diego vehicle will have a 70-mile range without recharging and will sell for $2,200. In Cleveland, production is starting on trucks that will sell for $4,500. The batteries are to be rented for about $30 a month. Operating costs of less than a cent a mile are anticipated for the battery-powered cars. The main market will be families that don't drive far. For this information, our thanks to the *Wall Street Journal.*

# Water Power by PENSTOCK...

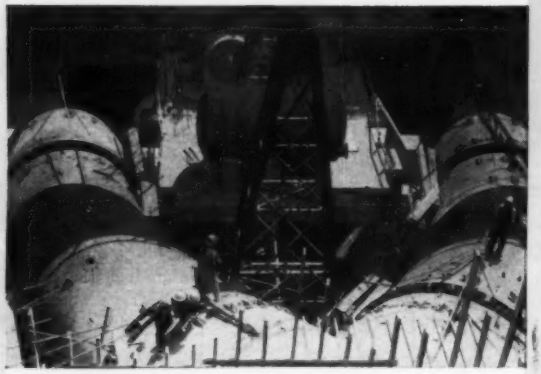
*Penstocks for Mountain Home*—CB&I built three, 22-ft. diam. penstocks for the Idaho Power Co.

Wherever water is diverted, harnessed or stored . . . you'll find the creative *craftsmanship in steel* of CB&I at work.

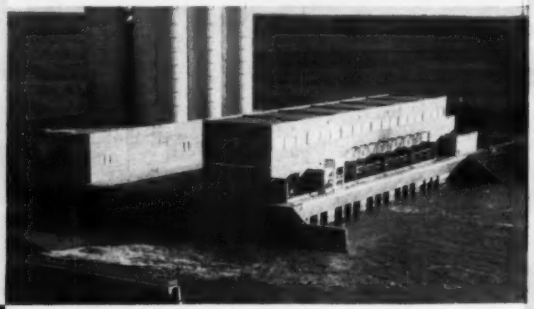
Seven decades of metallurgical know-how—under the expert supervision of engineering, fabrication and erection specialists who *know* pressure pipe and hydro-electric construction—go into each CB&I-built penstock, surge tank or power conduit.

This *single responsibility* service, backed by our four fully equipped and strategically located fabricating plants, is the reason why seasoned operators and contractors *rely on CB&I* to design, fabricate and erect to the most rigid specifications.

Write the nearest CB&I office for details. Ask for the *Blakely Mountain Dam* story.



*Wye at Blakely Mountain Dam* connects CB&I built power conduit, two penstocks and 149-foot high surge tank.



*Six Surge tanks at Garrison Dam* were fabricated and erected by CB&I to help control turbulence of the "Mighty Missouri" River. They are 65 ft. in dia. by 135 ft. high.

CB&I Shop *Fit-up of T-1 Scroll Case*—one of the largest ever built—for Noxon Rapids Dam. T-1 alloy construction of 24-ft. diam. case saved 50% in plate thickness. Reassembled and welded at site by a CB&I crew.

E60CB

## Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston • Kansas City (Mo.)
New Orleans • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • South Pasadena • Tulsa

PLANTS: Birmingham • Chicago • Salt Lake City • Greenville, Pa. • New Castle, Del.

SUBSIDIARIES:
Horton Steel Works Limited, Toronto; Chicago Bridge & Iron Company Ltd., Caracas; Chicago Bridge Limited, London; Chicago Bridge Construcoes Ltda., Rio de Janeiro

REPRESENTATIVES AND LICENSEES:
Australia, Cuba, England, France, Germany, Italy, Japan, Netherlands, Scotland

CIVIL ENGINEERING

From address to alumni and students of Manhattan College at Commodore Hotel, New York, N. Y., March 15, 1959

# Journey toward a successful life

FRANCIS S. FRIEL, President, ASCE, Albright & Friel, Inc., Philadelphia, Pa.

"A journey of a thousand miles," says an old Chinese proverb, "must begin with a single step." The journey toward a successful life, I think, is just like that. We do not arrive at our cherished goal in one great rush, but rather we move toward it in a succession of day-by-day accomplishments. I do not worry too much about the distant future because I have confidence that so long as I am moving ahead, the chances of reaching my ultimate goal are all in my favor.

Life isn't all cut and dried. Often when we least expect it, some bright opportunity opens up—possibly one quite removed from what we think is the goal of our dreams. It will come only if we have shown ourselves ready for it and deserving of it.

The most challenging problem today facing the professions and industry is the development of leaders for the future. Well trained engineers are urgently needed in both the technical and the management field. Future leaders will be drawn in increasing numbers from the ranks of these well-trained engineers.

The type of leadership to be expected will depend upon the quality of the education and the post-college training our young men will receive. The college graduate cannot continue his formal education indefinitely on a full-time basis; nevertheless he must continue his studies during his entire lifetime.

Closing the gap between the attitudes of the college campus and the realities of earning a living is not an easy task, as has been well stated by the Engineers Council for Professional Development. In college the student has been working primarily on a planned program, a curriculum laid out for him and prescribed by the faculty. During these years, he has had a well defined, basic objective—his degree. After graduation he must set his own objectives. He must establish a program of personal development that will help him to grow professionally and as steadily as he did in college.

The young graduate must realize that the final responsibility for advancement rests with him as an individual. The most singular mark of a professional man is his continuing interest in education as a medium of personal growth. However, experience has demonstrated that, unless the young graduate formulates such a self-improvement plan soon after he leaves college, he is not likely ever to do so.

Our excellent engineering societies afford a means for advancement. They hold meetings—many of them each month—to discuss the scientific, technical and economic problems with which it is our professional duty to deal. Members of these societies meet to consult on subjects of their daily work. They compare experiences. They give attention to engineering problems the solution of which will benefit all. These are technical problems, but they are also universal problems, and unless the technical problems of modern industrial science are well handled and honestly solved, we cannot hope to achieve the kind of productive life that will lead to the realization of our best ideals.

If the young man is to grasp fully the opportunities open to him, he must increase his competence; he must understand the social implications of his work and assume a measure of responsibility for them.

Let what I have said provide a backdrop against which you can examine with me four areas of responsibility:

1. The responsibility to cultivate a sense of vocation in what we do.
2. Our duty to prepare ourselves for professional competence.
3. Our obligations under the law.
4. The development of a social consciousness, the final area of responsibility to which I wish to call attention.

### The sense of vocation

Each of us has a vocation. We have evaluated our talents and desires and have decided that we want to be engineers. The talents and desires we have discovered within ourselves, which were the controlling factors in our choice of a way of life, were given to us by our Creator. They were and are His way of telling us what He wants us to do.

First we should realize that we would show the greatest ingratitude if we did not use and develop our talents. Next, and perhaps more important, we should stir within ourselves a deep, positive awareness of the dignity of our profession.

### Professional competence

A second general area of responsibility is that of professional competence. Since we are aware that there is true dignity in our calling, one unavoidable conclusion must emerge. Our dignity would be shattered by mediocrity; professional incompetence would make a mockery of our claim to be doing something worthwhile with our lives.

One growing and alarming tendency, which I have noticed in my forty years as a practicing engineer, may appear as something of an enigma to you. It is a source of considerable concern and puzzlement to me. It is this. While the facilities of education have progressively improved, and while both the quality of instruction and the caliber of aspirants to the professions has risen, still the graduates are characterized now more than ever before by a general carelessness and a spirit of nonchalant incompetence.

If by chance I am projecting this picture too far into the future, let me apply this appeal for competence to current classroom and laboratory occupations. This appeal is directed to those of you who are now in college. Nowhere beyond the classroom does the happy state of affairs exist where 70 percent is a passing grade. If you are satisfied with a problem or project that is 70 percent correct, let me assure you that industry and the professions will not be. Industry and the professions expect a grade of "A", a 100-percent effort and performance. Industry and the professions expect you now to be expending a grade "A", 100-percent effort on your studies.

### Speaking and writing

I wonder whether you are doing all you might to prepare yourselves now for the demands of a future executive post. In my own office, it has been my experience that many fine young people are incapable of representing us until we have provided them with further training, especially in writing and speaking. Time is lost and efficient operation suffers while these young men are learning how to transfer accurate technical knowledge into clear, concise written and spoken reports.

Another ability that is important is that of dealing courteously and effectively with people. No less important is the ability to work congenially with other members of one's own organization. And, of course, when an executive post is reached, it is of paramount importance to practice the art of "human engineering"—or "human relations"—the intricate business of managing men and coordinating their efforts toward a common goal.

If you are making no effort now to improve your ability to express yourself orally and in writing, if you lack tact and courtesy in human relations, you should realize that your education will not be complete or fully effective until you have done all in your power to acquire these abilities.

### Obligations under the law

A third general area of responsibility is our obligations under the law. Responsibilities are codified in a body of law. Success can be achieved only within the law.

Your sense of professional responsibility should be motive enough for you to accept and follow a code of professional ethics. Your chosen profession is not an easy one. Your religious convictions will not infrequently demand heroic virtue of you. The fact that there is corruption in the world does not exempt you from the responsibility to do the right thing. It is in this world that you must make your way—your choices and your decisions.

Often the pressure of expediency, and the awareness that strict adherence to the law might place you at a competitive disadvantage, will make the ugly exit of compromise momentarily attractive. But where compromise enters, professional integrity, and more basically, human dignity, departs. You must protect your integrity by holding fast to your professional ethics.

On occasions such as this, I feel it my duty to dwell on ethics. And I would like to point out the need for the acquisition by every professional man of the ethical principles that must guide him as a faithful practitioner of his profession. There are no hard and fast rules of conduct but there are certain standards of faithful service to the public, to one's employer, and to one's client, which all should follow. We must recognize these standards. In many respects they are like moral and personal laws. They are basic laws of society which cannot be violated.

Next on our list of responsibilities comes our duties to our fellow men, our social consciousness. Many of you will rise, or have already risen to executive and managerial positions. You find yourselves faced with the responsibility of making decisions—decisions that will have repercussions all the way out to the battlefields of the world. If your scale of values is a strictly selfish one you will blunder, and both people and nations—large and small—will suffer as a consequence.

Realize that every man is a person, that every human being has a God-given dignity which demands your respect. Your scale of values must always acknowledge the lowliest man as equal to the highest in the sight of God—and superior to the finest machine.

### And the future?

This generation has entered one of the great epochs of all time—the Scientific Revolution of the Twentieth Century. The course of human events has been likened to the flow of a great river, now moving slowly through quiet pools and now with explosive force and speed hurling itself through a series of rapids. For better or for worse, our generation is caught in the rapids and no one can predict when we will come out into quiet water again. For now the scientific revolution is in full swing, gaining momentum with each decade.

Indeed the rate of this revolution has been so great, its character so explosive, and its effects so all-inclusive, that although we can describe them we do not fully comprehend their implications for mankind.

We shall have to think our way to a solution of this problem, on the basis of a sound knowledge of the intimate interplay among a number of factors—science, social structures, political systems, divergent philosophies, and human needs and limitations. Our young engineers must equip themselves to help solve these problems.

# SOLAR ENERGY

## the solar furnace and the civil engineer

**BOYD C. RINGO, A.M. ASCE,**

Assistant Professor of Civil Engineering,

Michigan State University, East Lansing, Mich.

Jets, missiles, ICBM's, Sputniks, automatic computers—these are among the many new and startling developments of the past twenty years. To this fast-growing list of engineering achievements is now added a new source of energy—solar energy. Of course it is not the energy that is new but the method of concentrating it in usable form.

Rates of progress in various parts of the world are directly linked to the rate at which man has converted fuel supplies to heat and energy and the efficiency with which the conversion has been accomplished. Tremendous demands are now being made on the fuel supplies and reserves of the planet Earth. These demands are so great that new sources of energy are constantly being sought. The extremely complex technology of the modern world, and of the United States in particular, includes a vast array of equipment requiring continuous and concentrated power sources. As this technology advances, the population it supports is increasing and at the same time continually raising its standard of living. Thus, total energy requirements are increasing at a fantastic rate.

In the days of the steam-engine, the population of the Earth was three-quarters of a billion. Today it is 2½ billion and it shows promise of rising to 6 billion in the next one hundred years. The power requirement-time curve is unquestionably exponential in nature. The principal sources of energy at present are hydroelectric power and fossil fuels such as gas, oil, and coal. These fossil fuels are rapidly running out and will soon become too valuable to use as fuels because of their increasing value for various types of chemical synthesis. They will become analogous to wood, now too precious to be a common fuel.

One solution to this problem is nuclear power, or the fission reaction under controlled conditions. This is on the verge of becoming practical. However, the raw materials for this reaction, uranium and thorium, will be nearly exhausted in about 500 years. Thus, the two inexhaustible sources of energy (apart from hydroelectric and wind power) seem to be the hydrogen-bomb type of reaction, that is, the thermonuclear reaction, in which the principal fuel is heavy hydrogen or duterium, present in all water, and the energy of the sun, or solar energy.

This inexhaustible solar energy is also produced by a nuclear reaction started billions of years ago in the sun. It is similar to the hydrogen-bomb reaction except that instead of being explosive it has reached a point of equilibrium so that tremendous amounts of energy are being released at a nearly constant rate. Appreciable amounts of this energy, in the form of solar radiation, arrive at the surface of the Earth —about 32,000 times as much energy as the world uses for power purposes in a 24-hour period. (This does not include the energy utilized by plant life.)

Solar energy is measured in "langleys," one unit being one gram-calorie per square centimeter. One langley per minute is the equivalent of about one horsepower per square yard of surface area. The Sun, behaving as a "black body" (a perfect radiator) at a temperature of about 6,000 deg absolute, radiates approximately 100,000 langleys per min. Considering the rela-

tive diameters of the Sun and Earth and the 93 million miles that separate them, the Earth intercepts about ½ billionth of the Sun's radiated energy, or about 2 langleys per min at the top of the Earth's atmosphere. About two-thirds of this reaches the surface of the Earth, about 1⅓ langleys per min or its equivalent of 1⅓ hp per sq yd.

The foregoing discussion of population increase, technological progress, and energy requirements looks toward the future. But there is also an immediate need for this energy source. This need is in the field of materials testing, particularly in high-temperature research. Through the media of a concentrating device, the energy of the Sun can be collected and used for analysis of materials under conditions previously unobtainable. This concentrating device is known as the solar furnace, which has the ability to easily control high temperatures in uncontaminated atmospheres. Although the general energy problem is not yet critical, the need for rigorous testing of materials is already here as a result of increased missile velocities, extended times-of-flight for both missiles and passenger-carrying aircraft, and the demand for more efficient power plants and competitive atomic-power reactors.

For elemental solids as they are known today, the useful temperature limit is well below 7,000 deg F. Materials are needed that will withstand stresses and strains at temperatures far higher than these. In fact most present-day materials are inadequate at temperatures in excess of 2,000 deg F. The physical properties and constants of materials must be measured under extreme temperatures and varying conditions—often difficult to achieve. It has been found that a minute trace of impurity may have a controlling effect on the physical properties observed. Although it has been possible, for example, to obtain velocities of Mach 15 to 20 (the velocities of reentry into the Earth's atmosphere) in propulsion wind tunnels and in blow-down tunnels, it has not been possible, with 1958 materials, to achieve sufficiently high temperatures for materials research along with those high velocities. Solar heat and solar energy in general promise to be potentially the most valuable tool for development of needed materials.

For these reasons interest has turned to the production of a solar research furnace, to be followed ultimately by the commercial application of the principles developed. But the engineering problems must be solved first and it must be shown that a large solar furnace can be built.

The first use of solar energy is attributed to Archimedes, who is said to have used reflectors to set fire to an enemy fleet in 212 B. C. A few years ago the solar furnace was a curiosity. The number of furnaces in the United States grew from two in 1954 to 26 in 1957. With one exception, all are small and many are inefficient. To date, the majority of these furnaces have produced temperatures of less than 7,000 deg F over a small spot area less than ¼ in. to ½ in. in diameter. For numerous practical applications, temperatures as high as this are not mandatory, but the area of heat distribution is of great importance.

Solar furnaces can provide a concentration of energy sufficient to melt most if not all known materials. Briefly, the advantages of the solar furnace are its pure and uncontaminated heat, a heat source of exceptional quality and high degree, accurate control of the heat flux, and comparative flexibility in testing procedures. One of its principal shortcomings is that radiation is cut off by clouds and the approach of night.

The basic objective of the solar furnace is to concentrate the Sun's radiation at a "point." In the three-dimensional concentrator, usually a paraboloid of revolution, the focal point is the point of maximum heat concentration and is therefore the location of the testing area. In the larger solar furnaces, the size, weight and complexity of the test area demands that this area be nonmobile. This requires that the concentrator be a fixed structure also. Another mobile structure is therefore required to track the Sun and reflect the radiation. This structure is a large flat reflecting surface (actually a series of surfaces) called the heliostat. The large solar furnace thus consists of three basic elements—the concentrator (paraboloid), the test area, and the heliostat.

The large solar furnace produces a solar image called the "hot spot," actually a three-dimensional spot. This is not of constant intensity but varies from its maximum at the center to a lower intensity at the disk edge. The parabolic reflector as a concentrator is effective and relatively simple in principle, but this apparent simplicity is deceptive when the problem of designing and building it is considered. The basic function of the heliostat is to rotate about a vertical axis from east to west in following the Sun's path across the sky. At the same time its inclination must be varied so as to accurately reflect the Sun's rays.

The heliostat is an enormous structure requiring a much larger mirror reflecting surface than the paraboloid. As the Sun passes across the sky during the various seasons of the year, its image is traced on the inclined reflecting surface of the heliostat as a series of ellipses. A different ellipse is created for each combination of time (hour of the day) and season (day of the year). Since the flat surface of the heliostat's reflecting mirrors must envelope all these elipses, an exceptionaly large surface area is needed.

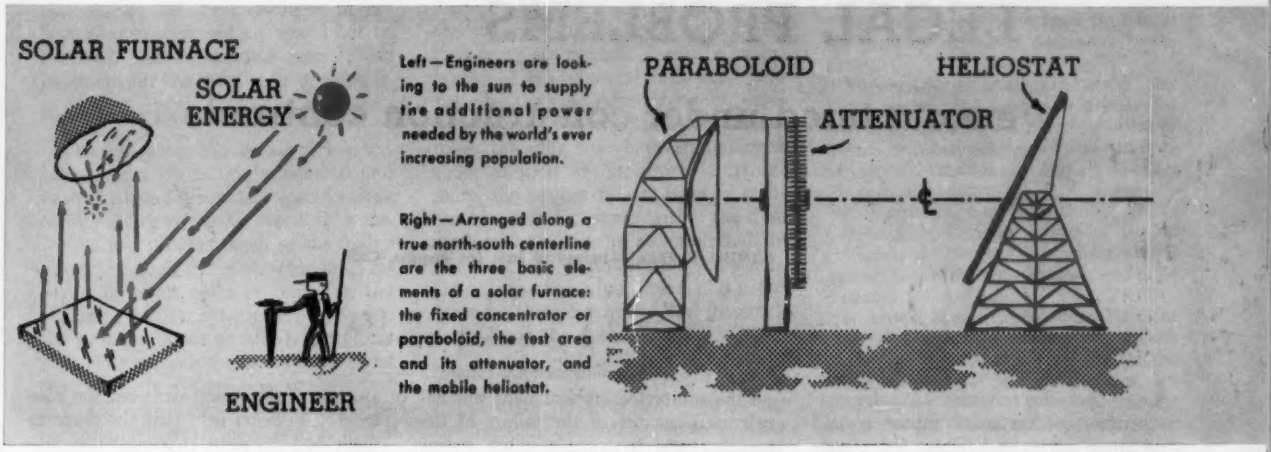
The latitude and elevation of the selected site, as well as the maximum declination of the Sun at that location, materially affects the obtainable flux density at the "hot spot." These factors also affect the distance between the elements of the furnace and to some extent control the selection of the site. The rim angle of the paraboloid, as dictated by the equation and size of the parabola, and the reflective qualities of the mirrors themselves directly control the efficiency with which the energy of the Sun is concentrated at the focal point of the paraboloid. As the size of the furnace increases, these factors become more critical.

The "unusually large" solar furnace which the Department of Defense currently contemplates building in New Mexico will have the usual fixed paraboloid and moving heliostat. An additional component will be an attenuator structure containing a large "Venetian blind" arrangement for varying the heat flux according to predetermined pulse patterns. The attenuator will also support the test chamber containing the "hot spot," which will have a diameter of 5 in. and will reach a temperature of about 7,000 deg F in theory. This particular furnace, the first of its size (with a concentrator 108 ft in diameter), is designed for a site at El. 8,825, near Cloudcroft, N. Mex. Because this site is in an earthquake zone, the design conditions are exceptionally severe.

The three principal components of this "unusually large" furnace—the paraboloid, the attenuator, and the heliostat—are all highly indeterminate. This materially complicates the analysis and design. The largeness of the furnace compounds the problems of fabrication and erection beyond normal bounds. Design is further complicated by the remoteness of the job site, the excessive wind forces to be expected, the need to provide for severe seismic loadings, and anchorage problems.

The optics of the furnace are obviously critical, particularly the quality and shape of the reflecting surfaces. The heliostat must be able to track the Sun with smooth rotational movements. Any deviation of the reflected rays will decrease the quality of the "hot spot."

Winds of approximately 100 miles an hour occur at the site. The effect of the




Left—Engineers are looking to the sun to supply the additional power needed by the world's ever increasing population.

Right—Arranged along a true north-south centerline are the three basic elements of a solar furnace: the fixed concentrator or paraboloid, the test area and its attenuator, and the mobile heliostat.

wind is increased by the "cupping" action of the paraboloid and the fact that components of both the heliostat and the attenuator act as large air foils. The protection of the mirror surfaces from the elements is of great importance. Potential seismic forces require secure anchorage of foundations to resist possible overturning and uplift. For this the geology of the crust of the Earth must be investigated.

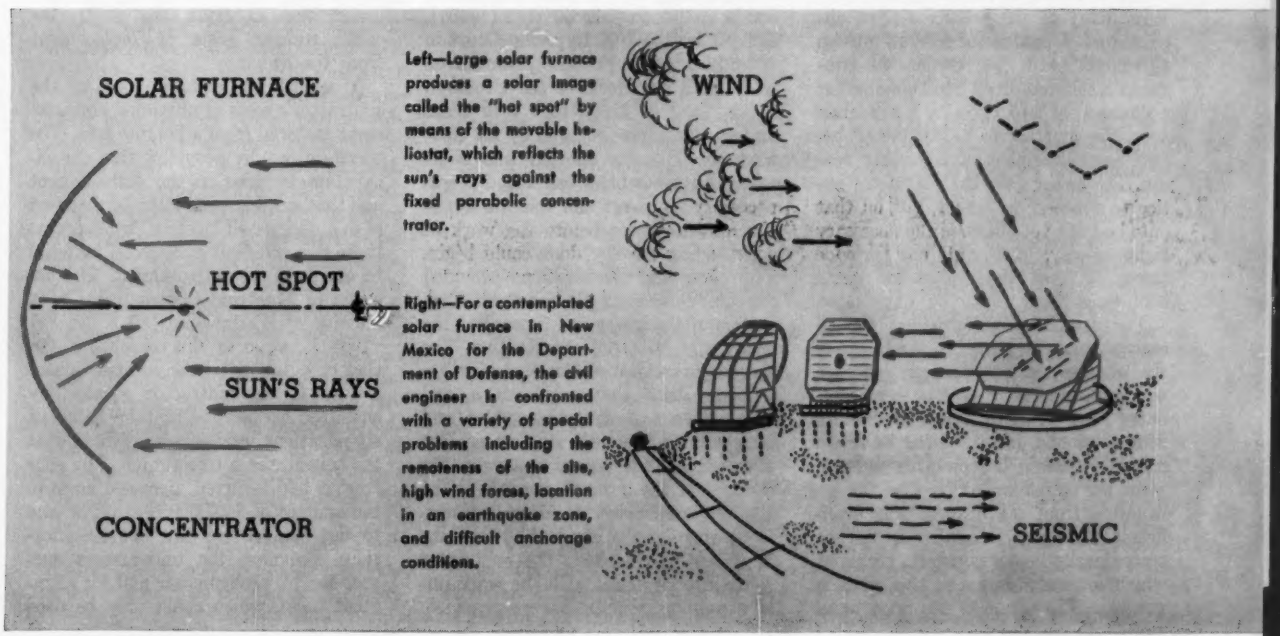
The optical and mechanical controls must be capable of accurately rotating a 1,000-ton structure around both a vertical and a horizontal axis, neither of which intersects the other. This problem is far from simple.

The test chamber is a project in itself including testing machines, measuring devices, and automatic safety features. The transportation of all components to the remote job site is a feat in itself, requiring a knowledge of railroad clearances, trucking capacities, and maximum highway axle loads. In addition, familiarity is required with the many standard codings, including those of the government.

The successful accomplishment of a project such as this is the product of the efforts of many people—a team effort. In a job that basically consists of little more than a building of steel without walls, a bridge that goes nowhere, and a large Venetian blind, the civil engineer encounters the fields of geology, physics, astronomy, electrical engineering, mechanical engineering and civil engineering. Even though each engineer need not be thoroughly conversant with all these areas of knowledge, he must be at least on speaking terms with them. In short, he must be able to help with the solution rather than becoming a part of the problem.

This paper was initiated in 1957, through the writer's association, as Senior Design Engineer, with the Pittsburgh-Des Moines Steel Company, Pittsburgh, Pa.

Those interested in pursuing this subject further may wish to consult the *Journal of Solar Energy Science and Engineering*, April-July 1957.




Left—Large solar furnace produces a solar image called the "hot spot" by means of the movable heliostat, which reflects the sun's rays against the fixed parabolic concentrator.

Right—For a contemplated solar furnace in New Mexico for the Department of Defense, the civil engineer is confronted with a variety of special problems including the remoteness of the site, high wind forces, location in an earthquake zone, and difficult anchorage conditions.

# LEGAL PROBLEMS

## encountered under construction contracts

SAMUEL S. GILL, Attorney at Law, Los Angeles, Calif.

Legal problems encountered under construction contracts encompass a field as broad as jurisprudence, for a contractor's attorney in advising him encounters problems in fields as diverse as taxation and workmen's compensation. The contractor's counsel may be required to examine international and foreign law, state and federal statutes, as well as municipal ordinances and regulations as he follows the contractor's operations from Thailand to Cucamonga. The contractor has a greater need for legal counsel than any other businessman, because each contract presents new problems in a new locale. It would obviously be impossible to mention more than a few such legal problems here.

Legal problems encountered in the actual performance of construction contracts in the field cannot be separated from the associated engineering problems.

### A hypothetical case

The following hypothetical case presents many of the problems often encountered. A contractor entered into an agreement with an owner to construct a concrete-lined flood channel for a distance of two miles in a suburban area, the contract to be completed before commencement of the rainy season. The owner gave the contractor notice to proceed on July 1, but on that date had not yet obtained the necessary rights-of-way, and did not provide them, so that the contractor could commence work, until 60 days later.

The specifications provided for all excavation to be placed in the banks of the channel, except for any surplus, which was to be disposed of in a designated area. Prior to December 20, the contractor had been required to obtain material from a borrow area to complete the embankment because the excavation from the channel was insufficient. Then, on December 20, an extraordinarily heavy rainstorm occurred, which seriously damaged the work in progress. The action of the flood water on the completed embankment was accelerated because of the failure of the specifications to include catch basins on streets crossing the channel, so that flood waters from the streets cut through the channel embankment.

The contract also specified a design mix for the concrete, which the contractor used. Those portions of the channel which were concrete lined before the flood were seriously damaged and the contractor contended that the cause was the poor quality of the concrete resulting from the mix design.

This hypothetical case raises many problems. First, the legal principle is well established that if the contractor is required to build according to the plans and specifications prepared by the owner, the contractor will not be responsible for the consequences of defects in the plans and specifications; and furthermore, in such case, the owner should compensate the contractor for extra costs required because of such defective specifications.

The leading case so holding is *United States v. Spearin* [248 U.S. 132 (1918)], decided by the U.S. Supreme Court in 1918. In this case, the contractor agreed to build a dry dock in the Brooklyn Navy Yard in accordance with plans and specifications prepared by the Government. The site selected was intersected by a 6-ft brick sewer and it was necessary to divert and relocate a section of this sewer before the work of constructing the dry dock could begin. The plans and specifications provided for the contractor to construct such section of the sewer and prescribed the dimensions, material and location. The contractor relocated the sewer in accordance with the specifications, and about a year afterward a sudden and heavy downpour of rain coincident with a high tide forced water up the sewer, and the internal pressure broke the relocated sewer in several places. Consequently the excavation for the dry dock was flooded. The contractor refused to go ahead with the work until adequate sewer lines were provided, and the Government canceled the contract. The court held that the Government had no right to cancel the contract and that the contractor was entitled to the costs incurred prior to the cancellation and to the profits lost by the wrongful termination of the contract.

### Owner's responsibility

Applying the legal principles of the *Spearin* case to our hypothetical case, it would appear that any damages caused by the failure of the specifications to provide catch basins and proper drainage where the streets crossed the flood channel would be the responsibility of the owner. Whether the specifications were defective in fact would require the determination of an engineering fact.

The same principle is applicable to the concrete lining. Whether the owner-designated mix design was proper for the concrete required in the lining would, of course, require an engineering opinion. If in such opinion the mix design was at fault, the contractor could recover costs of replacement from the owner.

A similar principle applies to the contractor's costs of obtaining embankment material from a borrow area. The specifications, by providing that the excavation be used in the embankment and that surplus excavation be disposed of in a designated location, implied that there was sufficient excavation material to complete the embankment. The decision in *Montrose Contracting Co. v. County of Westchester* [80 F. 2d 841 (1936)] supports this conclusion. In that case, involving the construction of a tunnel, the contractor successfully sustained his position that the plans and specifications impliedly warranted that the tunnel was a free-air job. The contractor had incurred increased costs in the amount of $497,000 because he had to use compressed air. The specifications provided for underdrains surrounded by broken stone and for alignment holes, which could only be used

on a free-air tunnel. Since the specifications had led the contractor to believe that compressed air would not be required, the contractor was given judgment for the extra costs of using it.

### Rights must be protected

The contractor has certain rights, but action must be taken to develop and protect them. When the specifications are defective so as to result in a defective end product, such as the faulty concrete lining, the contractor may recover his extra costs in replacing the concrete lining. Practically, however, the problem is not usually as simple as that. The owner's engineers may claim that the mix design was proper, but that the contractor failed to mix the concrete sufficiently or placed it under such conditions that it cracked. Therefore, in such a case it is important that the contractor not only call in his lawyer, but also obtain the advice of independent engineers at once so that the site can be examined, samples taken and tests made.

### Faulty specifications

When the specifications are faulty so as to cause damage to the contractor's work, as in the case of the defective drains into the channel, problems arise that call for an immediate analysis by the attorney and the engineer. The owner may contend that the drains provided would have been sufficient when the work was completed, and that the contractor had an obligation to provide temporary protection for the work during construction. And the owner may also contend that even with properly engineered drains the damage would have occurred. It is not enough to discuss the problem with the attorney and the independent engineer in their offices. Both professional men should be taken to the site as soon after the damage as possible. All specifications, plans, change orders, correspondence and other memoranda should be turned over to them for thorough study so that no problem will be missed.

When the specifications are faulty so that the contractor is deceived in estimating his costs, as in the case of the borrow for the embankment, the facts should be developed as the work progresses. The work papers used in preparing the bid should be preserved, so that the contractor's reliance on the specifications can be proved. The factual situation should be thoroughly explored and documented in order to preserve an adequate record of costs and to anticipate possible defenses by the owner.

In concluding this discussion about claims arising out of faulty specifications, it should be pointed out that not only is it essential to have analyses made of the specifications at once by the attorney and the engineer, but also that complete records should be maintained of the physical facts and field costs by the field superintendent, engineer and accountant. Such records may mean the difference between having a claim allowed or disallowed. Furthermore, the proper presentation of written notice to the owner within the time required can best be accomplished by the attorney, engineer and contractor acting together after ascertaining the facts in the field and after thorough analysis of the specifications.

### Owner-caused delays

The other phase of our hypothetical case presents the problem as to whether the contractor can recover for damages caused by delays of the owner. Such delays may be caused by failure of the owner to furnish a right-of-way as in our hypothetical case, or by the failure of the owner to furnish specified materials, equipment, drawings, models or other data required by the contract to be furnished by the owner, or by the owner's delay in making changes. In the absence of any contractual provision exculpating the owner from his acts, the owner impliedly obligates himself not to take any action that will hinder or delay performance by the contractor.

Many contracts, however, include clauses relieving the owner from liability for any owner-caused delay. A random review of some of the contracts in my office revealed the following:

1. A Los Angeles County Flood Control District contract includes the following language:

"Furthermore, if the Contractor shall suffer any delay caused by the failure of the District to furnish the necessary rights of way or materials agreed to be furnished by it, or by failure to supply necessary plans or instructions . . . the contractor . . . shall not be entitled to any damages for such delay."

2. The State of California, Division of Highways, Standard Specifications, provide:

"If the Contractor is delayed by reason of alterations . . ., or by any act of the Engineer or of the Division . . . the Contractor shall have no claim for any such delays."

But the Contractor is given a limited recovery for right-of-way delays.

"If through the failure of the State to acquire or clear rights-of-way, the Contractor sustains loss which could not have been avoided, there shall be paid to the Contractor such amount as the Engineer may find to be a fair and reasonable compensation for such part of the Contractor's actual loss. . . ."

3. A City of Los Angeles, Board of Public Works, contract provides for an extension of time in the case of owner delays, but does not expressly cover damages for such delays.

4. A subcontract form used by one of our clients, "a general contractor," provides:

"Subcontractor shall not make any claim against Contractor or Owner for any delay caused by any act or order of Owner or Contractor, and Sub-contractor expressly waives any and all damages for any such delays."

5. Standard Form 23A, United States Construction Contract, provides for an extension of time for Government-caused delays, but does not expressly refer to damages for such delays.

6. Article 31 of the Standard Form of General Conditions, American Institute of Architects, expressly provides for the reimbursement of the Contractor for damages because of any wrongful act or neglect of the Owner and expressly states in Article 18, "Delays and Extension of Time" that such article does not exclude the recovery of damages for delays.

The differences found in various contracts demonstrate the need for careful examination and analysis of the contract form and specifications before bidding. If the work situation is one where the Government or owner-caused delays may be likely and serious, and the contract attempts to exculpate the owner from such damages, the engineer estimator should allow for such a contingency in his estimate.

Even when the contract contains an exculpatory clause, the courts may in some situations require the owner to reimburse the contractor for owner-caused delays. An example is the case of *Ozark Dam Constructors v. United States* [127 F. Supp. 187 (1955)], decided by the Court of Claims. In this case, the contract required the Government to furnish the contractor with cement to build a dam. The specification paragraph relating to cement expressly provided:

"The Government will not be liable for any expense or delay caused the Contractor by delayed deliveries."

The Government failed to deliver the cement on schedule because of a railroad strike. The court considered that the contracting officer's failure to employ trucks to deliver the cement during the railroad strike was gross negligence. The court pointed out:

"A contract for immunity from the harmless consequences of one's own negligence always presents a serious question of public policy. That question seems to us to be particularly serious when, as in this case, if the Government got such immunity, it bought it by requiring bidders on a public contract to increase their bids to cover the contingency of damages caused to them by the negligence of the Government's agents. Why the Government would want to buy and pay for such an immunity is hard to imagine. If it does, by such a provision in a contract, get the coveted privilege it will win an

occasional battle, but lose the war." [127 F. Supp. at 190]

The court went on to state that such provision for non-liability might be effective with regard to some kinds or degrees of negligence, but when the possible consequences were so serious and the action necessary to prevent such consequences so slight, the neglect was almost wilful, and the non-liability clause was not applicable.

In the absence of an express non-liability clause, the United States Supreme Court has not held the Government responsible for delays unless there is negligence or a lack of diligence. Thus, in the case of *United States v. Howard P. Foley Co.* [329 U. S. 64 (1946)], the contractor was delayed in installing a field lighting system at an airport because the Government, as a result of an unstable soil condition, had been unable to make the runways available as scheduled. The court, in holding that the contractor could not recover for the delay damages, pointed out that the Government work had been performed with diligence.

In the case of delays caused by reason of authorized changes, the courts have held that the contractor can recover only where the delay is unreasonable [*Harwood-Nebel Construction Co. v. United States*, 105 Ct. Cl. 116 (1946); *Severin v. United States*, 102 Ct. Cl. 74 (1943)].

### Three causes of delay

The recent decision, *Peter Kiewit Sons' Co. v. United States* [151 F. Supp. 726 (1957)], decided by the Court of Claims, is an example of the application of legal principles to three separate factual causes of delay. There was no exculpatory clause involved.

The contractor entered into a Government contract of standard form to construct earthwork and structures for two power plants and the gatehouse, spillways and penstock connected to the power plants. The contract provided that the Government was to furnish the steel penstock, steel and iron pipes and fittings, electrical conduits, metal sash windows, and plumbing fixtures. The contractor claimed damages because of three Government-caused delays: (1) failure to deliver penstock pipe on schedule; (2) failure to deliver materials to be installed in concrete structures on time; and (3) failure to supply detail drawings as needed.

The court stated the legal principles involved as follows:

"Generally the Government is not liable for delays in making the work or material available to a contractor. However, where the Government or its authorized representatives are guilty of some act of negligence or willful misconduct which delays the contractor's performance, the Government is liable for the resulting damages. This is so because there is in every Government contract, as in all contracts, an implied obligation on the part of the Government not to willfully or negligently interfere with the contractor in the performance of his contract. . . . If the Government exerts every effort to supply the contractor with materials on time, it cannot be held that it has willfully or negligently interfered with performance." [151 F. Supp. at 731]

The court held that the delay damages from failure to deliver penstock pipe on schedule could be recovered because the order for the penstock was placed with a supplier who was at the time having difficulty in procuring steel, and a subsequent Government-placed order with the same supplier was given priority in delivery. Therefore, the Government breached the implied obligation.

In the case of the materials to be installed in the concrete, the Government, in accordance with its usual custom, did not place its order until after the contract was awarded. Thereafter, however, the Government tried to expedite deliveries by making awards to higher bidders because of better delivery dates, placing duplicate orders and accepting first deliveries, and by locating and designating substitute materials. The court held that under such circumstances the failure to furnish such materials as needed was not a breach of contract.

In the case of the delay caused by failure of the Government to furnish the detail drawings required in connection with pouring concrete, the court held that such act was a breach of contract. The Government offered no explanation as to why the drawings had not been prepared and delivered on time, except the volume of the work.

Returning to our hypothetical case, where the procurement of right-of-way delayed the contractor's work for 60 days, it appears that the contractor should be able to recover for damages for actual standby expenses for overhead and equipment during the delay and for the extra costs caused by the flood. The contractor, however, should establish that the delay in processing the right-of-way resulted from the owner's negligence. Moreover, he should be able to show that the work could not have been completed before the rainy season, as the owner may contend that despite the right-of-way delay the contractor could have expedited the work and mitigated damages.

In retrospect, we can advise the contractor how to protect his rights and establish his claim. When the contractor first becomes aware of the right-of-way delays he should call his attorney to diagnose the situation. For such diagnosis, the attorney will need the contract, specifications, plans, a good explanation of the job from the project engineer, a view of the work site and an investigation of the owner's actions in procuring the right-of-way.

After such diagnosis, a letter should be promptly delivered to the owner advising of the anticipated damage which may result if the delay continues. If the letter produces the right-of-way, the problem is solved. If the delay continues, the early documentation should make it easier to establish that the delay was caused by owner's negligence.

### Careful cost record needed

The record of costs during the actual delay period should be meticulously recorded and preserved. Work progress and problems encountered as the job continues should be recorded by the job engineer, for the claim may be later made by the owner that the work would have been completed sooner but for the incompetence or other acts of the contractor. When the flood occurs on December 20th, the contractor should enlist his attorney and an independent engineer and make certain they reach the job site at once. At this time, photographs of the conditions of the site should be taken, all possible witnesses interviewed and all possible facts and opinions developed. The owner should be promptly notified in writing of the contractor's position. Thereafter, the cost records of repairing the damage should be separately and carefully maintained.

The relationship between the engineer and the lawyer in handling the problems arising in the performance of contracts should be one of close cooperation. The lawyer should review with the engineer all the possible legal theories involved, so that the engineer will be aware of some of the engineering facts that are necessary to the development of a claim. On the other hand, the engineer should give the lawyer detailed and simple explanations of all the engineering principles and facts. Generally, I have found that engineers tend to abbreviate, as they have been trained to use equations and formulas. Most lawyers are accused of verbosity, but this trait probably is necessary as their presentations are generally to judges and juries without an engineering or construction background. The contractor in solving problems in the field and in preparing claims cannot do without the services of both professions.

*(This paper was originally presented by Mr. Gill at the ASCE Los Angeles Convention, at a Construction Division session presided over by O. C. Struthers, a member of the Division's Program Committee.)*

# *Great opportunities—*
# *in civil engineering research*

**LEE A. DuBRIDGE**, President, California Institute of Technology, Pasadena, Calif.

From his Awards Luncheon address, at the ASCE Los Angeles Convention

The civil engineer does not have too much control over the nature of the things he is supposed to do in research. A physicist or a chemist can look around and choose to do research on just about any subject he fancies, can continue in it as long as he chooses and then go on to something else. No one tells him what problems are urgent or require an immediate solution. In fact the physicist avoids urgent problems—those are for the engineer. The physicist asks not what is urgent, but what is interesting; not what is important but what is significant. It is evident that I am speaking largely as a physicist, which I am, or used to be.

The engineer of course lives in no such dream world. His problems are largely handed to him by some one else. The engineers had no interest in the experiments being carried out in a German laboratory in 1939 where a couple of physicists were watching what happened when various materials were placed near a weak source of neutrons. But a few years later the engineers were being asked why they didn't get busy and design nuclear power stations. And so, whether they were interested in nuclear fission or not, they had to get busy. And what happened to the physicists who made the discoveries that caused all the trouble? They lost interest as soon as the practical problems arose, and they are off tinkering with some more interesting experiments that will cause more trouble for future engineers—nuclear fusion perhaps.

And not only do the physicists and chemists cause trouble for the engineers, but the engineers create trouble for each other. Just when the civil engineer has satisfied himself that he knows how to build roads and bridges quite adequate for the needs of the horse and buggy, some inventors and mechanical engineers come along and make him redesign them to fit the needs of the automobile. And just when he has worked out designs for automobiles going 25 miles an hour he finds that drivers are trying to go 75 miles an hour—and some ten-ton trucks are pounding his fine road to pieces. Even the whims of the general public cause him trouble. On a road built to handle 100 cars a day he suddenly discovers 1,000 cars an hour.

But not only does the engineer get handed all these problems that he never asked for, he finds that when they are handed to him there are vast gaps in the information he requires to solve them. When the physicists turned over to the engineer the task of designing nuclear reactors they warned him that he had better be careful about shielding so that people would not be injured by the intense flood of neutrons and gamma rays. "Fine," says the engineer, "how do we do that?" "Oh," says the physicist, "that is your problem. We haven't had time to work that out yet It isn't a very interesting problem anyway—but it's very important and very urgent so you'd better get busy. And, oh yes, we almost forgot to tell you. Those neutrons seem to damage certain materials, too. You'd better look into that or else your reactor may collapse."

It is quite impossible for anyone—engineer *or* scientist—to predict what the urgent engineering problems of 25 years hence will be. Or even 5 years hence. So all the engineer can do is to be smart and alert and willing to move and move fast when the problem hits him. It helps too if he has had a good solid scientific training and if he keeps himself well informed on what is going on in science and in other engineering fields. He then has a better chance of anticipating what problems he will have to face shortly before they reach the "critically urgent" stage.

Thus both in his educational and in his research programs the engineer—by the very nature of his calling—is subject to influences beyond his control and beyond his ken.

But there are other influences that *are* within his control. The engineer is not completely at the mercy of external events. There are basic and long-range problems to which he can well give attention and which will almost surely profit him—and his clients—no matter what strange turns his fate may take. In addition to the wholly unforeseeable problems there are thousands of foreseeable ones which will be with us for a long time to come.

And this, it seems, is the task of those interested in engineering research—not to try to outguess or outdo the physicist, the chemist or the inventor or even the twists of public fancy, but to investigate (in addition to the immediately urgent problems) those areas which are of basic importance in *all* future engineering advance.

Regardless of what new scientific discoveries are made, the problem of supplying fresh water to large segments of a growing population—both in this and in other countries—will be a problem of growing magnitude and importance. Some people are inclined to dismiss this problem with the simple statement that, someday, atomic energy will take care of all that. But I remind you that atomic energy is only a form of heat; and right now it is an expensive form of heat. And in any case atomically produced heat can't do anything that heat produced by burning coal or oil can't do. And in most areas of this country the latter will be a lot cheaper for a long time to come.

And even if atomic heat does eventually become slightly cheaper than oil heat—so what? Would areas like southern California then use purified sea water? Perhaps. But here is a chance for the civil engineer to be clever and imaginative—to find ways of bringing fresh water to Los Angeles from the mountains of northern California less expensively than the mechanical and the chemical engineer can distill sea water right there. Both sides should get busy and find out which development is the most feasible. If the civil engineer is clever enough to pipe gas and oil from Texas to New York he should be able to move water too. We must remember there is not really any shortage of water in the United States as a whole. It just happens not to be in the right places to suit us. If we could redistribute, economically enough, the water that we already have, the supply would be ample.

There are some major research prob-

lems here, partly economic, partly political perhaps, partly geological or geographical. Other problems have to do with materials, fluid flow, pressure and friction distribution in pipes and channels, dam design, underground storage, and so on and on. In short, the opportunities for engineer-research teams are enormous just in looking into such long-range problems.

The engineering research laboratories have plenty of work to do. The questions are: where is this work going to be done, and who is going to pay for it?

In general, of course, research in pure or applied science is done either in universities, in industry, in government laboratories or in private research institutes. The weight is on the side of the universities in scientific fields and on the side of industry in most engineering fields. However, most branches of civil engineering are not the concern of the great industrial giants such as General Electric, A.T. & T., General Motors, Douglas Aircraft and all the rest, that do such a large part of the engineering research in the electrical, mechanical and chemical fields. This does not completely excuse the building, construction metal, and other industries for not supporting more research. Many of those companies are now fully large enough for the purpose; many others could make use of sponsored research in the industrial research institutes, such as Battelle, Stanford and Mellon. Or they could join together in industrial associations, like the Institute of Paper Chemistry and the American Petroleum Institute. Or they could make contributions to the research fund of the American Society of Civil Engineers —or directly to colleges and universities.

But if funds are to be provided for civil engineering research—whether carried out by industry, universities or government—the civil engineers themselves must be the primary instruments for securing these funds. Many universities are anxious to expand their engineering research programs and they have fine personnel available for the task. But funds must be found.

There are certain things to keep in mind when searching for funds:

First, it will not be effective to seek such funds with the plea that, if they are not forthcoming, the profession of civil engineering will suffer. No one outside any profession is willing to contribute very much just for the survival of the profession. Professions have become obsolete and have disappeared repeatedly since the beginning of time. No profession will survive unless it has a job to do and then goes ahead and does it, thus proving to the world that it has a valuable function to perform.

Now it is not my intention to suggest for a moment that civil engineers are becoming obsolete, or that the profession is going to seed. The point is only that funds should not be sought, as sometimes happens, on the basis that they will keep a profession alive. The request should be based solely on the importance of the job to be done and the competence of a particular group to do it.

Second, it is equally ineffective to ask for large sums for the vague purpose of "encouraging engineering research," "restoring the balance between research expenditures," and so on. Research funds are normally granted to specific people in specific laboratories for specific jobs to be done. Even the National Science Foundation does not attempt to decide for the good of the country whether it should spend $x$ dollars for physics research, $y$ dollars for biology and $z$ dollars for engineering. It looks at the number and the quality of the research proposals it receives, and from year to year estimates the funds it will need on the basis of those requirements. The way to get funds is not to pound the table and say "civil engineering deserves more money" but to submit a stack of valuable, worthwhile projects with a list of competent people who are ready to do them.

Third, research requires people—and a very special kind of people. The four-year graduate of a college course in civil engineering is not normally equipped to initiate and carry on effective research. He requires, probably, the equivalent of a doctor's degree in a good university and preferably also several years of practical experience. How many civil engineers are we turning out each year with this kind of training—and how many of those with practical training are seeking careers in research? Too few! Far too few! All too often in advising young people we stress the fact that the civil engineer is the *practical* man who builds bridges, roads, dams and highways. Seldom is it suggested that he may also contribute to the basic knowledge on which all these things depend.

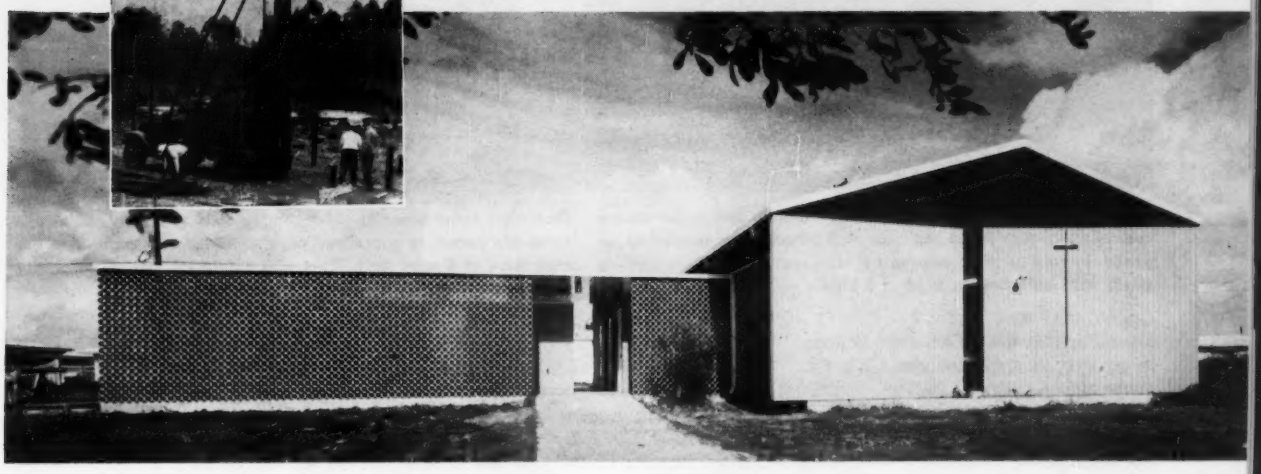
It can be stated with some certainty that funds for research will not come in ample amounts unless people are available to do the research and unless they are qualified and anxious to do it and have ideas about what they want to do.

This suggests that possibly the next research funds you can lay your hands on should go toward the establishment of a couple of hundred predoctoral and postdoctoral fellowships in the leading civil engineering departments in the universities and engineering schools of the country. That would cost between a quarter and a half million dollars a year after the program was well under way. It would be a tremendously profitable investment. That is precisely the way physics research got its start in this country in the days after World War I, with the establishment of the National Research Council fellowships, financed by the Rockefeller Foundation. Civil engineering research is far more advanced now than physics was in 1920, of course. But there are more competitors for the services of young people too. And bright young potential *research* people are not choosing civil engineering in large enough numbers. Here is a good place to start putting on the heat.

It is a rather shocking fact that, in 1958, at the beginning of the first school year after the dawn of the space age, in spite of all the enormous excitement caused by the first man-made satellites and the enormous amount of talk about science and engineering, the enrollment in the freshman classes of the nation's engineering colleges actually declined by about 11 percent over the previous year. *Declined!* What is going on here? Don't the American people know that one of the greatest engineering feats of all time was achieved by engineers? Or have they been led to think it was done by physicists? The first physicist who worked on space satellites was Sir Isaac Newton, who finished his calculations of orbital velocities some 300 years ago. Other physicists have contributed since, but now they have deserted the field, and space technology has now been opened up for engineers. Then why aren't our youngsters—who wear space helmets from the time they can walk—flocking into engineering?

Something is wrong. And until this tide is somehow reversed and young people start flocking into the field again, attracted not only by the immediate practical problems but by the exciting research areas, filled with possibilities for future achievement, the engineering research fields will not prosper as they should and will not attract the funds they should. Nothing succeeds like success.

Engineers have attained one success after another in recent years but when they talk to high school students what do they talk about? Building roads and earning lots of money! All right then, that's the kind of boys you will get, and that's where engineering will stick until some one comes along with the imagination to tell our young people the really exciting story about engineering adventures of the future. That is a task worthy of the best efforts of your distinguished society.



In an area where the soil bearing capacity is very low, Christ-the-King Lutheran Church (below), 10½ miles from downtown New Orleans, is adequately supported on poles driven for 3.5-ton capacity each. Left, pile-driving rig used for church has 3,000-lb drop-hammer falling a maximum of 6 to 8 ft, depending on conditions. Collapsible 35-ft leads are mounted on rear of half-track.

IRVING B. RAU, A.M. ASCE, Consulting Engineer, New Orleans, La.

# Telephone poles used as foundation piles in New Orleans area

Timber piles have been found effective and economical for use under light structures on the outskirts of New Orleans, where extensive building has recently taken place on soils with very poor bearing values. Three structures in this area are here discussed—a church, a store, and a residence.

The standard foundation for light structures and residences in New Orleans before World War II consisted of spread footings bearing on the soft alluvial clay deposits that make up the area. Building was generally limited to areas that had been developed for some time and provided with drainage and sewerage facilities—all with the resulting lowering of the ground-water table and firming up of the soil. Many of the older structures on spread footings are showing signs of distress from settlement caused by desiccation and consolidation.

After World War II, New Orleans started building at an unprecedented rate. After all available land in the already densely populated section had been utilized, the city burst its limits and started moving out into areas that used to be pastures and swamps.

New Orleans is surrounded by water—Lake Pontchartrain on the north, the mighty Mississippi River on the south, swamps on the east, and more swamps on the west. Civil engineers are constantly overcoming these obstacles. Bridges across the lake and the river have recently been built as well as levees and drainage facilities to make low-lying swamps suitable for development. There are not many heavy structures in the outlying areas. Those that are built there are supported on ASTM Class B timber piles or on concrete piles with supporting values of 12 tons or more, and are beyond the scope of this article.

Most of the structures are either residences or small commercial buildings one or two stories in height. The soils near the surface are soft clays and silts that contain a large amount of organic matter, have a low bearing capacity, and are subject to excessive settlement due to desiccation and consolidation. For these reasons practically all these structures are pile supported.

For an economical foundation design for these light structures it has been found expedient to use timber piles that conform to the "American Standard Specifications and Dimensions for Wood Poles," American Standard 05.1-1948. The piles are treated with creosote or a creosote coal-tar solution to a net final retention of 8 lb per cu ft of wood. For dimensions of a Class 5 pole, see Table I, except that in the longer lengths an 8-in. minimum diameter at the butt is allowed. The maximum length usually used for friction piles is 30 ft. If a satisfactory stratum for end bearing is found at a lesser depth, a shorter pile is used. Treating with a preservative is necessary because the cutoff elevation is high and these structures are in areas where the ground-water table will be lowered in the coming years.

A good example of this type of construction is Christ-the-King Lutheran Church (Fig. 1), which is located 10½

**Residence of the architect, M. Wayne Stoffle, has substructure consisting of reinforced-concrete slab structurally supported on grade beams, in turn supported on seventy-five 30-ft friction piles, with safe design load of 3.5 tons per pile.**

**One-story retail store in older section of city, where soil conditions are better, is supported on 30-ft Class 5 poles with a design load of 6 tons each. Test pile safely supported twice the design load with settlement after rebound of 0.06 in.**

air miles from downtown New Orleans in an area that was inaccessible a few years ago.

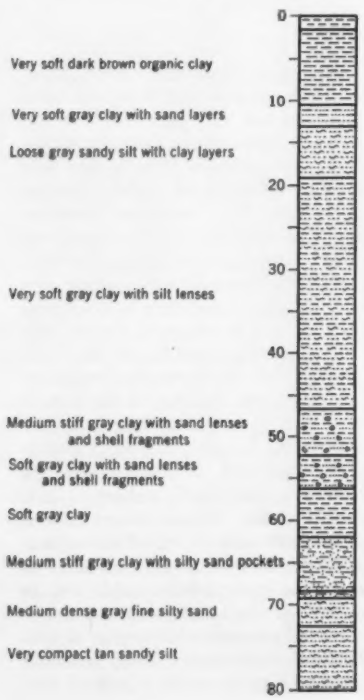
The log of the one boring taken is shown in Fig. 2. On top there is a very soft organic clay about 13 ft deep, then a 6-ft stratum of loose gray sandy silt; next soft gray clays 27 ft thick; then strata of soft to medium stiff gray clays containing sand lenses about 23 ft thick; and finally, strata of medium dense sands and very compact sandy silt, from the 69-ft depth to the bottom of the boring at a depth of 80 ft.

The results of soil mechanics laboratory tests are shown in Table II. The very soft clays down to the 46-ft depth were found to have unconfined compressive strengths of from 195 to 460 psf. Below the 46-ft depth the unconfined compressive strengths ranged from 825 to 1,400 psf. This is typical of the soils in these outlying areas.

The use of a 50-ft treated timber pile, ASTM Class B, seemed unwarranted in view of the lightness of the structure that was to be supported. Class 5 poles 30 ft long were used, designed as friction piles. The cohesion was taken as half the unconfined compressive strength. With a factor of safety of 2, a design value of 3.5 tons per pile was obtained.

These piles drive easily, somewhere in the order of one to six blows per foot. The butts do not broom much and only occasionally have to be cut off. Standard practice is to drive them to grade without cutoff. Should a pile broom or split while being driven, the driving is stopped and the pile is cut off while the butt is about one foot above the ground. Driving is then immediately resumed, and the pile is driven to grade without excessive brooming. Piles are driven with a 3,000-lb drop-hammer falling a maximum of 6 to 8 ft, depending on conditions. The pile-driving rig has collapsible 35-ft leads mounted on the rear of a half-track.

The floor slab of this church is structurally supported on grade beams. The slab and beams are poured integrally directly on the subgrade. Interior grade beams do not have to be formed; exterior grade beams have only the exterior side formed. The pile cap is punched out of the soil by the pile hood. The pile cap is poured without forming. Typical foundation details are


0
10
20
30
40
50
60
70
80
Very soft dark brown organic clay
Very soft gray clay with sand layers
Loose gray sandy silt with clay layers
Very soft gray clay with silt lenses
Medium stiff gray clay with sand lenses and shell fragments
Soft gray clay with sand lenses and shell fragments
Soft gray clay
Medium stiff gray clay with silty sand pockets
Medium dense gray fine silty sand
Very compact tan sandy silt

**◀FIG. 2. Log of boring for the church.**

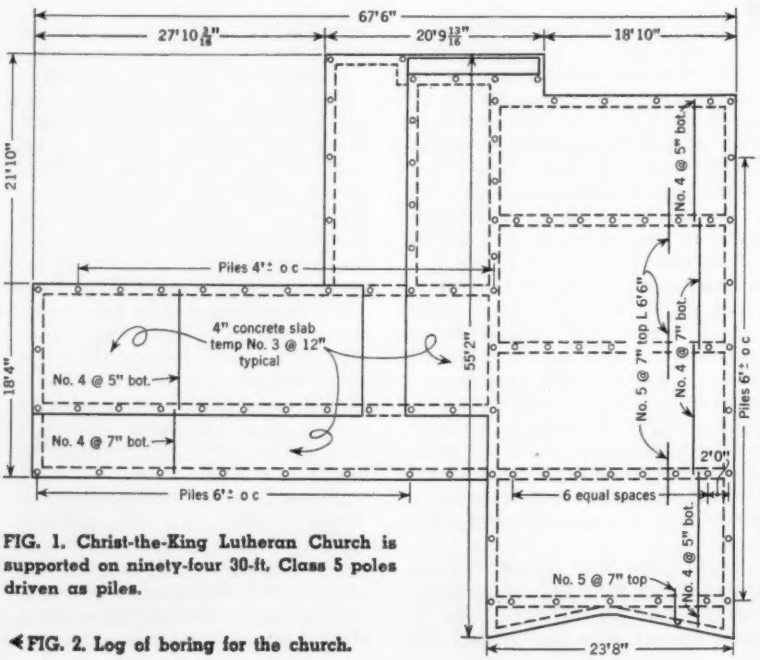



**FIG. 1. Christ-the-King Lutheran Church is supported on ninety-four 30-ft. Class 5 poles driven as piles.**

shown in Figs. 1 and 3. This church is supported by 94 piles.

An example of a commercial structure for which these small piles were used is the one-story retail store located in an older section of the city, in an area where the soil conditions are better. The foundation was designed using 30-ft Class 5 poles with a design load of 6 tons. One test pile was driven and test loaded. It safely supported twice the design load with an allowable net settlement after rebound of less than 0.06 in.

The floor slab is a floating slab supported directly on the subgrade. The grade beams and interior pile caps support the walls and roof. Grade beams are formed only on the sides. This structure contains 109 piles.

For residential work a smaller and less expensive pile is used. The residence of the architect, W. Wayne Stoffle, is a typical example. Needless to say, basements below grade are not built in the New Orleans area.

The residence substructure is a reinforced-concrete slab structurally supported on grade beams. The grade beams are pile supported, and are poured directly on the subgrade, the only form being an exterior side form on the exterior grade beam. On many small residences the pile foundations are not designed at all, but a spacing is chosen from experience. A pile spacing of 6 to 8 ft is used frequently. For residential work a Class 9 pole is used, treated with creosote or a creosote coal-tar solution to a net final retention of 8 lb per cu ft of wood. The dimensions for a Class 9 Southern Pine pole is a minimum tip circumference of 15 in., or a tip diameter of approximately 4¾ in. There is no butt requirement; butts range from 5 to 7 in. in diameter.

This residence, located 4½ air miles from downtown New Orleans, is supported on 30-ft friction piles. The soil is better than that under the church, as can be seen from the boring log shown in Fig. 4 and the results of soil-mechanics laboratory tests in Table III. Based on a cohesion value of one-half the unconfined compressive strength and a factor of safety of 2, the safe design load is 3.5 tons per pile. This residence is supported on 75 piles.

These Class 5 and Class 9 poles provide an economical solution to the foundation requirements for light structures in this area. Such poles are used extensively in the New Orleans area and are allowed by the Building Code.

The architect for the church and residence was M. Wayne Stoffle; the architect for the retail store was Diboll-Kessels & Associates. The writer served as consulting structural engineer on all three structures. All are in New Orleans.

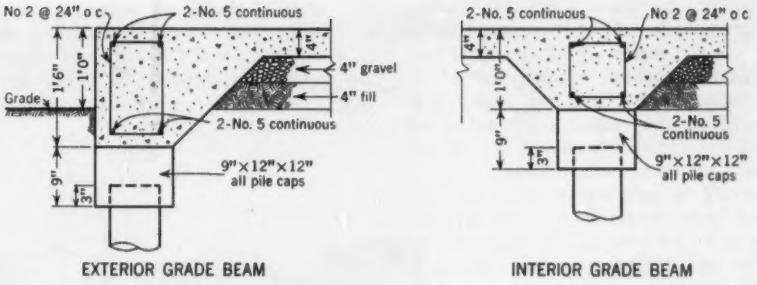



**FIG. 3. Grade-beam details for Christ-the-King Lutheran Church, founded on piles**

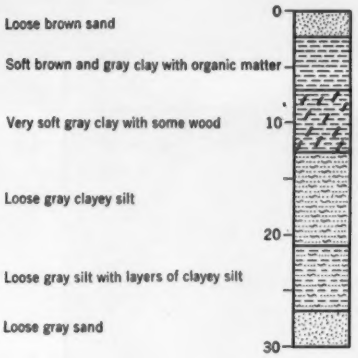



**TABLE I. Class 5, Southern Pine pole, used for piles**

| Length, ft | Min. Circumference 6 ft from Butt, in. | Min. Diameter 6 ft from Butt, in. |
|---|---|---|
| 16 | 21.5 | 6.9 (Approx.) |
| 18 | 22.5 | 7.2 |
| 20 | 23.5 | 7.5 |
| 22 | 24.5 | 7.8 |
| 25 | 26.0 | 8.3 |
| 30 | 28.0 | 8.9 |

All lengths: Tip circumference = 19 in.; tip diameter = 6.0 in. (approx.)

**FIG. 4. Log of boring for residence of architect, M. Wayne Stoffle.**

**TABLE II. Summary of laboratory tests on undisturbed samples**

*From boring for Christ-the-King Lutheran Church*

| Sample No. | Depth, ft | Classification | Water Content, % | Density, lb per cu ft | | Unconfined Compressive Strength, psf |
|---|---|---|---|---|---|---|
| | | | | Dry | Wet | |
| 2 | 8.5 | Very soft dark brown organic clay with wood | 172.8 | 27.2 | 74.2 | 360 |
| 3 | 11.0 | Very soft gray clay with sand layers | 44.8 | 74.2 | 107.4 | 195 |
| 4 | 14.0 | Loose gray sandy silt with clay layers | 30.7 | 89.0 | 116.3 | 1,180* |
| 7 | 24.0 | Very soft gray clay with silt lenses | 71.2 | 55.5 | 95.0 | 230 |
| 9 | 34.0 | Very soft gray clay with silt lenses | 70.0 | 55.1 | 93.7 | 425 |
| 12 | 49.0 | Med. stiff gray clay with sand lenses & shell fragments | 68.7 | 57.5 | 97.0 | 1,400 |
| 14 | 59.0 | Soft gray clay | 59.7 | 61.6 | 98.4 | 825 |
| 15 | 64.0 | Med. stiff gray clay with silty sand pockets | 41.2 | 77.4 | 109.3 | 1,200 |

*Confined compressive strength at 6 psi.

**TABLE III. Summary of laboratory tests on undisturbed samples**

*From boring for residence of M. Wayne Stoffle*

| Sample No. | Depth, ft | Classification | Water Content, % | Density, lb per cu ft | | Unconfined Compressive Strength, psf |
|---|---|---|---|---|---|---|
| | | | | Dry | Wet | |
| 2 | 2.0 | Medium stiff brown & gray clay with organic matter | 48.9 | 69.9 | 104.1 | 1,335 |
| 4 | 8.5 | Very soft gray clay with some wood | 51.2 | 70.9 | 107.2 | 145 |
| 6 | 14.0 | Loose gray clayey silt | 43.5 | 77.5 | 111.2 | 650* |

*Confined compressive strength at 5 psi.

Wheels of diamond grinding machine leave non-skid pattern on pavement surface.

# Grinding with diamond blades smooths Illinois Tollway

**GEORGE L. JACKSON, M. ASCE,**

Chief Engineer, Illinois State

Toll Highway Commission, Chicago, Ill.

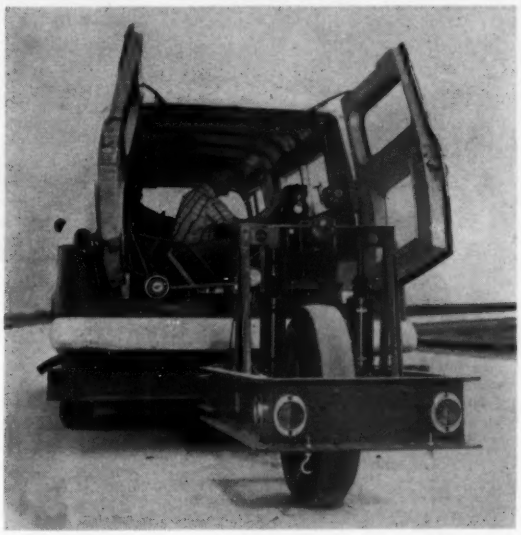
Diamond grinding blades helped contractors on the 187-mile Illinois Tollway to economically meet a rigid tolerance specification for surface variation of the pavement. On this recently opened Tollway, which will speed traffic into and around Chicago, specifications permit variations of only ⅛ in. in 16 ft on straightaway road surfaces and ⅛ in. in 10 ft on bridges.

Grinding of pavement surfaces with diamond blades has been previously used to smooth the surfaces of runways used for the landing of jet aircraft at high speeds. It shows promise of being a practical means of finishing highway surfaces to extremely close tolerances.

The specifications for the Illinois Tollway were drawn up to insure driver comfort and safety, and low upkeep costs. At high speeds, very slight surface variations in paved roads create uncomfortable shock in automobiles. Tires and suspension parts take extra punishment, and it is harder to hold the car on a steady course. The impact of heavily loaded truck tires against the smallest bumps puts extra stress on the pavement, increasing maintenance.

It has been found that the weight of automobiles and trucks dropping suddenly from a higher surface to a lower surface causes premature deterioration

**A diamond grinding machine smooths a pavement joint on the Illinois Tollway. Adjustable to exact cutting depths, it can take off 7/16 in. of concrete and aggregate as fast as 10 lin ft per min. Hydraulic controls regulate the forward motion of the cutter, which varies with the depth of cut. A 70-hp Lycoming engine powers the grinder.**



**A smoothometer charts a profile of the pavement on the 187-mile Illinois Tollway by means of a "fifth wheel" towed by a fitted panel truck.**

in pavement. Frequently the development of "scallops" or "corduroy" surfaces can be traced back to excessive surface variation in the pavement when it was originally laid. With these facts in mind, the engineers drew up the following specifications for concrete pavement surfaces on the Tollway:

"Surface shall be swept clean and tested for smoothness by means of an approved surface-testing machine which will test one or more lines, as determined by the engineer, on each side of pavement. All surface variations of one-eighth inch or more on a 16-ft length of pavement shall be ground off to within the specified tolerance at a time and in a manner satisfactory to the engineer. Bush hammering will not be permitted."

These were the most exacting surface specifications for highways ever encountered by many of the contractors on the project. Because of variations in the composition of the concrete and in curing conditions, they found it difficult to lay paving material to these close tolerances.

Where the Tollway surface varied more than the allowed amount, power grinding machines were employed. Grinding machines of types used previously were inexact. At first, out-of-tolerance pavement surfaces were scored by means of spikes on revolving drums and then smoothed off with silicon carbide or aluminum oxide cup-shaped grinding wheels. The pounding of the spikes sometimes dug too deeply or weakened pavement edges. Because ordinary abrasive wheels wore rapidly in the grinding operation, constantly changing in dimensions, it was practically impossible to remove an exact, predetermined amount of concrete from the paved surface. Irregular areas sometimes had to be removed and relaid.

At this point, it came to the attention of the Tollway contractors that two firms, Concut, Inc., a California producer of pavement grinding machines, and Super-Cut, Inc., an Illinois producer of diamond blades, had cooperated in the development of a machine to solve surface problems in aircraft runway construction. The machine they had developed, called a "bump cutter," used from 90 to 105 narrow circular diamond blades mounted on a horizontal shaft to take exact, preset cuts off the top of a concrete surface. The metal-bonded blades, impregnated with natural diamond powder of a relatively large sieve size, lost only two-tenths of a thousandth of an inch in diameter during an hour of grinding a runway surface. This is a relatively low-cost method compared to that of removing and replacing the pavement.

The "bump cutter" has the advantage of leaving a "non-skid" surface pattern. Its water-cooled blades generate little heat in the pavement and produce almost no vibration. The contractor who first used diamond grinding, at Davis-Monthan Air Force Base, smoothed the entire surface of Taxiway No. 14 at a cost of approximately $4,000. The cost of completely resurfacing the area, his other alternative, would have amounted to about $100,000.

On the Illinois Tollway the "bump cutter" was demonstrated for officials of the Toll Highway Commission and a number of the contractors on the project. While the specifications do not require diamond grinding, it has proved to be the most efficient and economical method of removing surface irregularities from pavement on roads, bridge approaches and bridge decks on various sections of the Tollway.

The "bump cutter" service was provided to Tollway contractors by Concut Mid-America, Inc., a Chicago based firm which operated the diamond grinding operation on a subcontract basis. Initially only one machine was available for use on the Tollway. It was soon in demand 24 hours a day, using three shifts of operators. A second "bump cutter" was then placed in service.

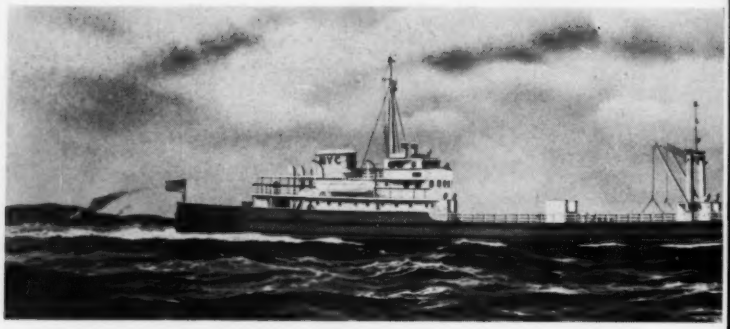
The prime contractor furnished his own water and, for night work, his own lights. The machines continued in operation despite subfreezing weather. During extremely cold weather the blades were cooled with salt water to prevent freezing.

The operating speed of the diamond grinder depends on the height of the surface irregularities it is cutting. In grinding off variations up to 7/16 of an inch in height, the machine moves forward at about 10 ft a minute.

Contractors' actual cost figures are not available. However, the "bump cutter" service was performed by Concut for contractors on the Illinois Tollway at the rate of $45 an hour, including personnel for operating the machine. To this must be added the cost of water for cooling, and electric lights for night work, which were supplied by the prime contractor. The "bump cutter" averages 10 lin ft a minute. Since its head is 18 in. wide, the average is 15 sq ft a minute, or about five cents per sq ft, plus the cost of water and lights. This does not allow time for moves between bumps or other delays.

Now the runway-smooth expanses of diamond-finished pavement on the Illinois Tollway, completed in December 1958, are offering drivers a new experience in safe, comfortable motoring.

# New York sludge goes to sea— or to parks



**WILLIAM A. O'LEARY, M.ASCE**
Director, Division of Sewage Disposal, Department of Public Works
New York, N. Y.

Sludge disposal by barge to sea has proved very satisfactory in the City of New York. The City's Department of Public Works, and its predecessor the Department of Sanitation, has found this method economical, sanitary and extremely flexible. Current costs of $0.66 per wet ton and $13.70 per dry ton are believed to be only a third or a quarter the cost of vacuum filtration and incineration when all factors are evaluated.

Another important consideration is the proximity of the treatment plants to residential areas, which probably would make it most difficult to get approval for sludge incineration.

An interesting development in connection with the disposal of digested sludge in New York is its use by the Park Department to produce synthetic topsoil on completed landfills. Experience to date indicates that such sludge, mixed with sand fill, will produce satisfactory green cover at a fraction of the cost of importing topsoil. It is estimated that over a million cu yd of topsoil will be required to fill the city's needs in the next few years, a yardage that is not available inside the city limits or within economical reach of it. The cost, if available, would probably exceed $5,000,000. At present 5 to 10 percent of the digested sludge produced is conveyed to existing and proposed park areas. This cooperative undertaking with the Park Department was instituted after a study and report by the late Clarence C. Combs, landscape architect and soil agronomist. The rest of the sludge is disposed of by barge to sea.

Modern sewage treatment in the City of New York had its start in 1935 when the first stage of the Coney Island Sewage Treatment Works was placed in operation to treat 35 mgd. Through the following years additional sewage treatment plants were constructed so that the total installed capacity in modern plants as of 1958 was 901.5 mgd. Of this, 820 mgd is of the activated sludge type, employing either step aeration or modified aeration with the activated aeration alternative incorporated into three of these plants. Table I indicates the capacity of each of the treatment plants now in operation. Total sewage flow to all plants is currently about 800 mgd. Reasonably satisfactory sludge thickening facilities are installed at four plants: Bowery Bay, Jamaica, 26th Ward and Oakwood Beach. The ultimate capacity of the existing plants as well as new facilities that are still to be constructed is expected to reach around 1,750 mgd.

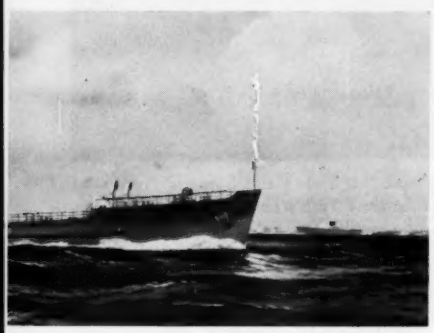
Normal sludge disposal from all but three small plants (Port Richmond, Oakwood Beach and City Island-Hart Island) is by transfer to sea-going diesel-operated vessels which dump the sludge at a point 8 nautical miles east south-east of Scotland Lightship, about 12 miles from shore. At the Coney Island Plant a pressure pipeline has been constructed to a dock on Sheepshead Bay for loading sea-going barges. These facilities are employed only occasionally, however, since practically the entire output of digested sludge from this plant is taken to Marine Park in Brooklyn by small barges hauled by rented tugs, an operation that has been in progress for over 20 years. Transfer of sludge from storage to vessels is by gravity except at the Coney Island and 26th Ward plants, where pumping is employed. Sludge from the Wards Island Plant is raw; that from all other plants is digested.

Currently, about half of the total sludge production from the entire system originates at Wards Island as raw, undigested sludge. In 1957, of the 91,000 dry tons removed to sea, 45,500 tons were produced at Wards Island.

### Production of synthetic soil

As previously mentioned, 5 to 10 percent of the digested sludge produced is conveyed to park areas. Not only does the Coney Island Plant send practically all its sludge to Marine Park in Brooklyn; almost the entire output of the 26th Ward Plant is now being pumped to Canarsie Pol in Jamaica Bay as part of a synthetic soil program; and the Oakwood Beach plant is pumping its output to Great Kills Park on Staten Island. At Port Richmond the sludge is dried on sludge beds at the site and transported to Great Kills Park by truck. The City Island-Hart Island

**Diesel-operated sea-going vessels are used to transfer the sludge to a dumping point 12 miles from shore. Operating with a crew of 10 or 11 men, the ship can complete a trip in an 8-hour day.**



sludge is dried on sludge beds and used on Hart Island for soil conditioning. The output from the Jamaica Plant is being pumped to Spring Creek Park to further another synthetic topsoil program.

In connection with this program, the Park Department constructed a sludge unloading and pumping station on Mill Basin in Jamaica Bay so that the Department of Public Works can deliver wet sludge at this point for unloading and delivery to Marine Park in Brooklyn. A four-hour unloading time was contemplated in the original design; the actual time was found to approximate 4½ hours. In Fig. 1 the park areas being developed are shown with relation to the sewage treatment plants. About 1,700 acres are planned to be covered with synthetic topsoil produced from digested sludge.

### Grit removed with sludge

At two of the larger plants, Owls Head and Bowery Bay, unwashed grit removed from the grit chambers is ejected by compressed air to the sludge storage tanks for removal to sea with the digested sludge. This operation is a distinct sanitary achievement but is not without its problems. The grit tends to accumulate in the hoppers of the sludge vessels and must be flushed out periodically. A new vessel, now under construction, will incorporate facilities for flushing the sludge hoppers with sea water.

**FIG. 1. Plan is to cover about 1,700 acres with synthetic topsoil produced from digested sludge. Map shows relationship between parks being developed and sewage treatment plants.**

**LEGEND**

| Parks | Sewage Treatment Plants |
|---|---|
| A. Marine Park | 1. Bowery Bay |
| B. Spring Creek Park | 2. Coney Island |
| C. Great Kills Park | 3. Tallmans Island |
| D. Kissena Park | 4. Hunts Point |
| E. Ferry Point Park | 5. Jamaica |
| F. Soundview Park | 6. Oakwood Beach |
| | 7. Owls Head |
| | 8. Port Richmond |
| | 9. Rockaway |
| | 10. 26th Ward |

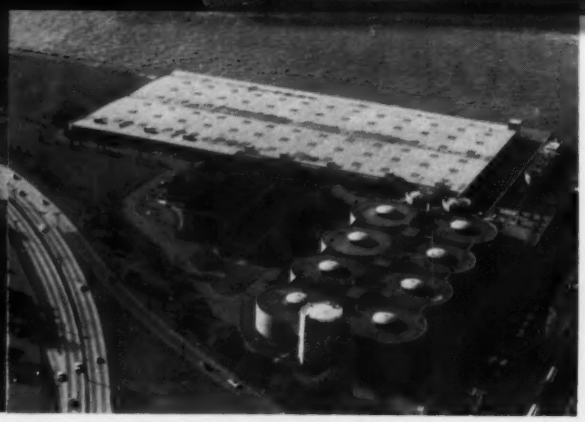
**Table I. Installed capacity of New York sewage treatment plants**

| Plant | Capacity, mgd | Plant | Capacity, mgd |
|---|---|---|---|
| Coney Island | 70 | Owls Head | 160 |
| Wards Island | 225 | Hunts Point | 120 |
| Tallmans Island | 40 | Rockaway | 15 |
| Bowery Bay | 120 | Port Richmond | 10 |
| City Island-Hart Island | 1.5 | Oakwood Beach | 15 |
| Jamaica | 65 | | |
| 26th Ward | 60 | Total | 901.5 |

**Table II. Design characteristics of diesel vessels for sludge transport**

| Vessel | Overall Length, ft | Midship Beam, ft | Midship Depth, ft | Design Mean Load Draft (Midship), ft |
|---|---|---|---|---|
| Wards Island | 260 | 43.5 | 16.0 | 11.0 |
| Tallmans Island | 260 | 43.5 | 16.0 | 11.0 |
| Coney Island | 260 | 43.5 | 16.0 | 11.0 |
| Owls Head | 283 | 45 | 17.0 | 12.0 |
| Bowery Bay | 283 | 45 | 17.0 | 12.0 |

As part of a synthetic soil program, the Oakwood Beach plant, with a capacity of 15 mgd, is pumping its sludge to Great Kills Park, background. Sludge beds, at right, are held in reserve.



With a capacity of 160 mgd, the Owls Head Sewage Treatment Plant is an integral part of New York's sludge disposal system. A diesel-operated sludge vessel is seen docked at plant.

The sludge fleet consists of four diesel-operated vessels. Three have a dead-weight cargo capacity of 1,600 short tons, or 50,000 cu ft, and the fourth, a capacity of 2,200 short tons, or 65,000 cu ft. A fifth vessel of the latter class is now under construction. These vessels operate at speeds up to 11 knots and carry sufficient fuel for a cruising radius of 2,500 miles. Table II gives salient details of vessel characteristics.

Hulls and superstructures are of steel except for the roofing of the housing and guard rails, which are of wood. There are two decks within the hull, which is subdivided longitudinally into seven principal watertight compartments by transverse bulkheads that extend from the keel to the under side of the main deck. Propulsion is by two diesel engines driving separate screws.

The cargo space, which extends from the forecastle bulkhead aft to the engine-room bulkhead, is divided into six main subdivisions by a continuous center-line watertight bulkhead and by two intermediate, transverse, watertight bulkheads. These compartments are again subdivided into chambers of uniform length by transverse, nonwatertight partitions that function as swash bulkheads to arrest any fore-and-aft surging of the sludge when the boat pitches in a sea. The center-line bulkhead minimizes any lateral surge induced by rolling of the craft.

Beneath and throughout the length and breadth of the sludge compartments there is a succession of air spaces which assure the vessel the necessary reserve of buoyancy when loaded; and forward and aft of the buoyancy compartments are ballast tanks that can be filled or drained of water to give the ship any desired trim. Each sludge tank has two connections to the sea through 18-in. pipes that lead from the bottom of the tank down through the buoyancy compartment beneath. At the top of the pipe, in the sludge compartment, is a valve that can be opened or closed by the turning of an attached stem that extends up to a hand wheel on the main deck.

The 14-in. sludge-filling main is on the main deck and has connections with the principal divisional compartments. Ventilation is through exhausters atop the king posts and aft of the pilothouse.

When fully laden, the vessels draw 11 ft of water and the top surface of the sludge in the compartments is 5 ft above the load line. This head makes it possible for the sludge to discharge freely and quickly as soon as the outlet valves are opened. When the tanks are empty there is a head of about 9 in. between the bottoms of the tanks and the surface of the sea. Any one of the main tanks can be discharged completely in 4½ minutes. The speed of complete unloading depends upon the type and concentration of sludge, as well as how fast the outlet valves can be opened by the deck hands. About twenty minutes is the average time required to unload the sludge.

### Odor control

Loading of raw sludge at Wards Island is associated with an odor problem. This has been combated by activated-carbon canisters placed on the vent pipes from the sludge compartments and other methods, none of which has proved entirely satisfactory. Equipment has been installed to permit discharge of the odorous vented air from the sludge compartments of the vessels to the upper section of the sludge storage building where ozone is admixed with the contaminated air from the sludge storage tanks before venting to the atmosphere.

### Advantages of disposal at sea

Disposal of sludge at sea has inherent advantages as compared with other methods. The most important is of course its relatively low cost. Another advantage is freedom from major nuisance. After twenty years of operation, complaints of nuisance are minimal. Most complaints are connected with odors associated with loading the vessels with raw sludge at Wards Island. These odors have been reported opposite the plant on the east side of the East River on several occasions. Some improvement has been obtained, however, by various palliatives as mentioned previously. The final solution here will be the construction of digestion tanks. Other complaints deal mainly with waves caused by the vessels in their course up and down the East River.

A third advantage is elasticity of operation. Vessels can be dispatched to plants at any time to meet either a normal sludge removal schedule or an emergency situation such as the unloading of a digester in need of cleaning or before a repair or alteration contract is started. When new plants or extensions are placed in service, the sludge vessels are used to transport digested sludge for seeding purposes from operating digesters at other plants to the new digesters. This operation has on occasion puzzled the personnel of the Harbor Supervisor who collect tickets from the vessels on the way to the dumping grounds. Failure to surrender a ticket, with the explanation that the material is being unloaded at another plant, generally causes some "arching of eyebrows."

Among other advantages is the ability to achieve complete disposal, including ash. If vacuum filtration and incineration were employed, the ash residue would have to be removed—probably via truck to some disposal point.

The vessel now under construction will include pumping facilities to enable the delivery of the digested sludge to shore areas for drying and use in the formation of synthetic topsoil. Many such areas, such as Fresh Kills on Staten Island, will require such treatment when the landfill operation is

complete. Detailed plans for installing such sludge unloading facilities on the existing vessels have been prepared and await the development of the plans of the Park Department. This ability to deliver digested sludge to shore areas is an advantage which it is expected will be exploited in the future.

### Operational difficulties

As might be expected, there are many problems involved in operating sludge vessels in fair and foul weather. Scheduled trips are delayed by fog and hurricanes. Experience through the years has taught us how to cope with most but not all of nature's tantrums. When hurricanes threaten and phenomenally high water is expected in the East River, the vessels are moored at berths in the North River. Protracted cold waves, with temperatures below zero Fahrenheit, have bad effects on vessels and crews. During the winter of 1957-1958 a crack that developed in the larger vessel, *Owls Head*, was diagnosed as a brittle fracture caused by very low temperatures. To make matters worse the vessel had to be unloaded at the Wards Island dock by pumping the raw sludge back into the storage tanks.

### Economics of disposal

The cost of disposing of sludge at sea has been carefully evaluated, including all related charges, as follows:

1. Wages and salaries of marine personnel and the City's contribution to the pensions, health insurance and social security of this personnel.
2. Overhead and administrative charges against marine personnel, plus the City's contribution to pensions.
3. Supplies for and repairs to sludge vessels.
4. Maintenance of and repairs to structures utilized for sludge removal as follows:
   a) Docks
   b) Dredging of areas in vicinity of docks
   c) Storage tanks and pipelines
5. Interest and amortization on:
   a) Sludge vessels
   b) Shore facilities

Digestion tanks and related facilities have not been charged to the sludge-disposal function. Sludge can be handled in either the raw or the digested state. Before the use of high-rate digestion and the latest methods of sludge thickening, it was demonstrable that the reduction in sludge volume due to digestion and decantation without prior thickening justified the use of digestion without giving any credit for the value of the gas for power generation and heat recovery. Today we consider that sludge should be concentrated before digestion and that no further reduction of any significance occurs during high-rate digestion. There is, of course, a substantial reduction due to decantation where conventional digestion is practiced. It is questionable, however, whether sewage treatment in a large city like New York can be considered satisfactory unless digestion is employed for odor control.

**Table III. Sludge-vessel operating costs**

*In thousands of dollars*

| Cost Item | 1939-41 | 1946-51 | 1953 | 1955 | 1957 |
|---|---|---|---|---|---|
| Salaries and wages, marine personnel | 85.8 | 159.7 | 359.0 | 386.9 | 458.7 |
| Pensions and other benefits | 8.6 | 16.0 | 48.5 | 52.3 | 67.8 |
| Overhead and administration | 7.9 | 15.7 | 33.2 | 43.5 | 41.2 |
| Pensions and other benefits | 0.8 | 1.6 | 4.5 | 5.8 | 6.1 |
| Supplies and repairs to sludge vessels | 58.5 | 158.3 | 332.1 | 321.0 | 346.8 |
| Repairs and maintenance to shore facilities | 10.7 | 40.1 | 18.5 | 18.5 | 18.5 |
| Interest and amortization for vessels | 80.0 | 98.0 | 158.0 | 158.0 | 158.0 |
| Interest and amortization for shore facilities | 28.4 | 81.8 | 152.5 | 152.5 | 152.5 |
| Total cost of sludge to sea | 286.9 | 571.4 | 1,126.3 | 1,137.5 | 1,349.7 |
| Unit cost in dollars per wet ton | $0.183 | $0.390 | 0.538 | 0.635 | 0.664 |
| Unit cost in dollars per dry ton | 4.83 | 9.72 | 12.15 | 12.85 | 13.70 |
| Thousands of wet tons to sea | 1,568 | 1,469 | 2,090 | 1,792 | 1,880 |
| Thousands of dry tons to sea | 59.39 | 58.94 | 92.50 | 88.60 | 91.01 |

Table III summarizes the basic operating costs for the sludge vessels for various periods from 1939 to 1957. The time after 1951 embraces the period of operation with four vessels and many new plants. In the early years of operation, from 1939 to 1945, the three smaller vessels were operated as merchant vessels with trips to sea scheduled as needed at any time around the clock. The crews were maintained aboard the vessels with food provided by the City. A crew of 17 men per vessel was required under this classification. In 1945, as a result of difficulties arising from labor relations with the marine personnel, the vessels were classified as public vessels, which called for a different schedule of operation with a crew of 10 or 11 per vessel. Under this method of operation a different crew mans the vessel on each trip, which, in general, consumes one 8-hour day. With vacation time, paid holidays, sick leave, dry-docking time, repair time at the plant dock, and security watches during lay-up time, the general costs of personnel under the two methods of operation are comparable.

At present seven crews are utilized to provide the required number of trips, a vessel generally averaging one trip per day. The marine personnel are members of organized unions whose wages approximate those earned by union labor on other comparable vessels operating in the harbor.

In calculating interest and amortization on vessels and shore facilities, 25-year serial bonds were used for the vessels and 30-year serial bonds for the shore facilities. The interest rate was taken as 3½ percent in both cases, giving a combined yearly charge of 5.75 percent against the sludge vessels and 5.08 percent against the shore facilities for both interest and amortization.

The total cost of shore facilities chargeable to sludge disposal at sea is estimated as about $3,000,000 at present. This investment was built up gradually as successive plants were put into operation.

The rapid increase in the cost of sludge removal in the post World War II years reflects mainly the increasing costs of marine labor. This increasing cost trend is being combated by rigid control of vessel scheduling and also by efforts to increase sludge concentration in order to reduce the tonnage being dumped at sea.

The Department of Public Works keeps a close check on the costs of sludge removal in New York Harbor by private contract. Thus far the Department has managed to keep the costs lower than competing organizations, based on removal of all sludge from all plants. We have had offers of attractive unit prices from private operators for removal from certain plants. There does not, however, appear to be any advantage in having the low-cost part of our load handled by private contract, leaving the higher-cost segment under our control.

When the vessel now under construction is delivered, we expect to achieve certain economies by concentrating operations in the vessels of larger capacity. Our records show that the cost per wet ton of sludge removed in the large vessel is about half that of removal in the smaller vessels.

*(This article is based on the paper presented by Mr. O'Leary at the New York ASCE Convention, in the Sanitary Engineering Division's Panel Discussion on Procedures and Economics of Sludge Disposal in Coastal Cities, with Arthur D. Caster, Secretary of the Division's Executive Committee, as moderator.)*

# *What price socialization of engineering?*

**DONALD A. WALSH, A.M. ASCE**

Chief Civil Engineer, Meissner Engineers, Inc., Chicago, Ill.

In recent years the trend toward socialization of the civil engineering profession in the United States has been progressing at an alarming rate. If this trend continues, all well-meaning efforts of the various engineering societies to gain professional recognition will have been for a lost cause. It is my purpose here to point out the dangers that the inroads of government into this phase of private enterprise will create, and what should be done to avoid them.

By "socialization" of the engineering profession I refer to the performance of engineering services by government agencies. The civil engineering profession should fight this growth as strongly as it has fought against unionization. If this had been done in the past, we would not be faced with the problem today. It is not too difficult to visualize how socialization of the profession could be a fate much worse than unionization.

The medical profession has so far successfully fought against the socialization of medicine through a strong aggressive national society. The civil engineering profession, however, is losing its battle against socialization by default, through lack of adequately coordinated leadership and the general disinterest of the members.

I have roughly estimated that at the present time approximately 70 percent of all civil engineers are employed by some form of government agency. It is the remaining 30 percent, however, operating under free enterprise, that have provided the economic leverage whereby increases in salary levels for the entire profession have been maintained at a level more or less consistent with the general economy of the country. Were it not for competition between government and private enterprise for the remaining 30 percent of the civil engineers, salary levels would, in all probability, be much less than they currently are. If socialization were 100 percent complete, the law of supply and demand would be disregarded and the civil engineer would be reduced to the status of a postal worker, relying on the whims and fancies of political bodies for any economic or professional gains he might realize.

One may logically ask, "What have been the motivating factors behind this trend toward socialization?" In the highway consulting field there can be no doubt that the Bureau of Public Roads has been the prime mover behind the building up of the state highway departments, while at the same time paying lip service to the principles of free enterprise. The reasons behind such an attitude would be difficult to determine, but bureaucracy has always tried to set itself up as a cure-all for any shortcomings that private enterprise may temporarily exhibit.

During the beginnings of the accelerated highway program undoubtedly many consultants, new to the highway engineering field, made "mistakes" in design judgment. An analysis of these "mistakes," however, will usually reveal nothing more than differences in professional opinion. From my own observations I am certain that they were not of such magnitude as to make it necessary for the state highway departments to do all the design work themselves.

On the contrary, I would say that such a solution would indicate a lack of leadership and supervisory ability on the part of the state highway departments. Instead of trying to correct the basic faults of inadequate supervision, the opposite solution has been attempted, that of building up their own staffs on the assumption that they can do the work much better and more efficiently themselves. This same analysis of the causes of the growth of bureaucracy can easily be applied to other fields of civil engineering where work is now being performed by governmental agencies. The extent of this growth is much more advanced than might appear on the surface.

Recently the Michigan State Highway Department announced, quite proudly, that they had increased their own staff to such an extent that they would do all their own engineering work in the future. Granted that the recent large increase in highway work may necessitate some increase in staff, will it be reduced when the work is completed? If it is not reduced, what of the security promised to the engineers? If it is not reduced, what of efficiency? Socialization might be expected in a state such as California where socialistic enterprises are accepted as the proper way of life. However, to have it happen here in the Midwest, our citadel of free enterprise, is a measure of the seriousness of the situation.

Many claims have been made in recent years with regard to the cost of public versus private engineering. I will not attempt to answer this question here. The burden of proof, however, seems to lie with the public engineering agencies. They often make claims of their efficiency with little in the way of facts to back them up. This is not true of the private consultant. He could not remain in business very long if he did not know what the "actual" costs of carrying on his business are. To my knowledge there has never been a detailed certified analysis of the cost of performing engineering services in any governmental agency. If such an analysis has been made, it is one of the best kept secrets since the A-bomb.

Not only have some agencies under-

taken all their own design engineering but they have branched out into other related fields of engineering as well. At least five states have acquired all their own photogrammetric equipment, including airplanes, to do aerial mapping and surveying. This has been done even though there are numerous private firms completely capable of providing this service. Soils engineering is another field in which many states own their own drilling equipment. The economic justification for the acquisition of some of this equipment would certainly make interesting reading.

The highway department of a major Western state announced recently that it had reduced its current administrative budget from that of the previous year by over $1,500,000, the current budget amounting to slightly over $16,000,000. The total value of construction for the previous year was around $31,000,000. Undoubtedly such an administrative budget includes many services other than design engineering, such as planning, traffic surveys, construction supervision, R.O.W. work, materials testing and public relations but I would venture to say that the difference in the budget alone, from one year to the next, would have been a sufficient fee for a private firm to produce $31,000,000 worth of construction drawings.

Studies by the Hoover Commission on the costs of performing engineering services in the Federal Government showed that in some instances it was nearly 18 percent of the construction cost. No private engineering firm, to my knowledge, was ever given such a fee for providing engineering services. The ASCE fee curve gives recommended fees varying from about 2.5 percent for large simple projects to around 10 percent for more complicated smaller projects.

It is not my contention that the government should never provide engineering services. One of the principal functions of our form of government is to provide those services which cannot be performed by private enterprise. Many projects, although socially desirable, could never be undertaken by private enterprise. When an economically feasible project cannot be handled by an individual or group of individuals because they cannot assemble the resources, cannot stand the risk, or want an early return on their investment, the public must act if the best use of our resources is to be achieved. The general public has direct interest in all developments that are too large or too risky for individuals to attempt, or where coordination with other activities is necessary. Decisions with respect to the planning of such projects must be made by some public body if the facility is to provide maximum benefits not only for the present population but for future generations as well.

The foregoing statements imply a function of government that could best be described as "engineering planning." In conjunction with this function the next step would be "programming" for the design and construction of those projects deemed most urgent for the general welfare. Finally, a certain amount of "supervision" would be required to see that the facility is designed and constructed as specified. These three functions should properly be supplied by a governmental body of some sort.

"Planning, programming and supervision" therefore represent the extent of the role of government in engineering. Private enterprise is completely capable of undertaking properly planned projects and of designing, constructing and operating them. With the current availability of private consulting firms there is no need for government to enter these fields.

To fulfill its proper functions the government should have the services of the best engineering talent available. At present, however, many engineers look on government service with disrespect and outright disgust. Many governmental agencies have become political dumping grounds for less competent and less efficient engineers who value security above pride and who lack the qualities of the truly professional engineer. Many of these men, to cover up their own incompetence, insist upon letting as few outsiders as possible view their activities, giving as their reasons certain unfounded economic advantages to be gained by performing all phases of the work themselves. As most administrators of governmental agencies and commissions are not engineers, they generally accept such explanations without questioning their validity.

The status of the professional engineer in government should parallel that of the judge in the legal profession. His major function would be to compare competing private firms and choose the best qualified to perform particular services for the government. By this means, valuable competition to attain engineering excellence would develop in all consulting firms. The results of such an activity of truly professional rivalry would result in accelerated advances in engineering techniques and ideas which would be of tremendous benefit to our society. Such developments are now limited to that small fraction of the profession which has this incentive.

It is widely recognized that private consultants have contributed more than their share to technical advances in the civil engineering field, as compared with publicly employed engineering organizations. The reason for this obvious discrepancy lies in the lack of incentive for engineers in public service. The writer does not deny that there have been many outstanding men in government service who have contributed significantly to the progress of our profession; he merely advocates that the abilities of such men be encouraged by providing added incentive.

That most engineers prefer private enterprise to bureaucracy is evidenced by the losses of personnel from governmental agencies to consulting firms during the last "boom" period. Although this trend has slowed somewhat now, it will undoubtedly be repeated during the next favorable business cycle. This is definitely not beneficial for any governmental agency. Actually the trend should be in the opposite direction, that is, men in private practice should take key government jobs in the phases of engineering previously discussed. An engineer who has worked in private enterprise is more aware of the value of time and money than one who has served his apprenticeship in government service. This is not to say that all government engineers are inefficient and that all those in private enterprises are efficient, but there can be no doubt that the competitive atmosphere of free enterprise starts a young engineer out with a set of values not duplicated in government service.

The professional attitude toward engineering positions in government must be upgraded to a point where such positions will be sought after by the most capable engineers. The salary levels should be sufficiently above those paid in private enterprise to attract men of the caliber needed to render important engineering decisions.

The general attitude of those in government regarding the professional status of the engineering profession has long been a matter of considerable discussion. Competitive bidding for engineering services has been one of the lesser shortcomings. The most striking example of this unprofessional attitude has been the so-called "anti-pirating" clauses in government engineering contracts. It seems that the engineer is not accorded the same degree of freedom to work where and for whom he pleases as the Constitution might have intended. To impose such restrictions on the personal freedom of government employees does not encourage others to seek government positions. Having failed by purely competitive means to hold their staff, these government groups, it seems, are making an effort to drive the consultant out of business

by witholding design contracts from him. With the consultants out of business, all engineers, with the exception of the few in industrial and commercial work, would have to end up as employees of the government, and socialization of the civil engineering profession would be practically complete.

Disregarding the loss of prospective business to those engaged in free enterprise by such a step, the dangers to the profession itself must be considered. Will socialization stop here? Is the next step the actual construction of engineering works by government? Definite inroads have already been made in this field by some governmental agencies. After construction would undoubtedly come the acquisition of the cement plants, steel mills, etc., that supply the materials of construction. This is not a wild-eyed vision of what in all probability will not happen; it is a realistic appraisal of what is actually happening today.

The effort to "socialize" the civil engineering profession has long been recognized by many prominent engineers. For business reasons, however, they have not openly criticized the growth of governmental engineering offices. There have been some exceptions, and undoubtedly more criticism will be voiced in the future as the noose is tightened.

Many engineering publications make a point of staying clear of this issue, giving as their reason the fact that it is too "controversial." Of that there can be no doubt. But it will never be resolved unless brought into the open and discussed by all members of the profession. It has been lurking beneath the surface for too long. The President himself has indicated that he favors the use of private enterprise wherever possible in our economy. From present indications, this desire seems never to have gone beyond the White House.

For all those who strive for true professional recognition, this is a subject that should not be passed over lightly. Not only must it be discussed by all members of the profession but the public must be made aware of the situation through any means at our disposal. Every political, fraternal, legal and social weapon should be used. We must stand our ground—here—now.

We must show the world that ours is not a society which looks to government for the solution of all state, local and even personal problems, that we are not a society that looks first for security instead of opportunity, and that we are not afraid of the chances and responsibilities of life. The present reckless course toward socialization, if continued, will undermine the very foundations of our liberty.



# Polygonal shape simplifies pipe prestressing

**ROLF SCHJODT, M. ASCE,** Dr. Techn., Norwegian Building Research Institute, Oslo, Norway

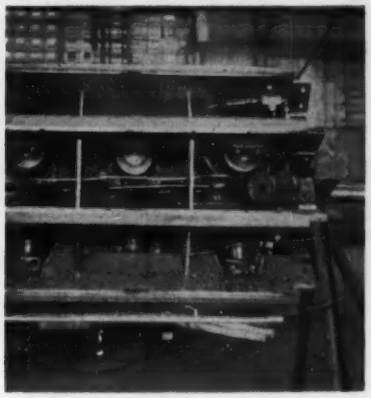
Simplified equipment has been developed for the manufacture of prestressed concrete pipe of polygonal shape in a Norwegian project. The pipe and equipment are designed for use on projects where hauling is difficult and an elaborate prestressing plant is not economical. Pipe of 32-in. nominal diameter with a 3-in. wall, having 18 wires of 0.16-in. diameter (a 260,000-psi breaking strength) per foot of length, will withstand 650 ft of head.

Concrete is a cheap material and pipe made of concrete needs little maintenance. But concrete normally is a poor material for resisting tensile stresses. Circular prestressing of pipe requires a large investment in plant if many steps in fabrication are to be carried through efficiently. Therefore, installation of a field factory is practical only for very large projects. Such pipe usually is made with an inner core, then wound with tensioned wire, over which a thin external layer of mortar is placed to protect the reinforcement. This outer layer may spall, permitting corrosion of the steel.

If the pipe is given a polygonal shape, the need for circular reinforcing is avoided, as will be seen in Fig. 1. The interior water pressure causes bending moment in the polygonal sides, and a corresponding tension. But this tension is again eliminated at working pressures through an eccentricity of the reinforcement in relation to the center line of the wall. This eccentricity results in a bending moment of opposite sign to the moment from the water head. At test pressures, usually 1.2 times water head plus water hammer, a certain tension from the bending moment appears. But this tension acts only over half of

Concrete is placed for bottom of pipe. Note external vibrator. Prestressing wires are wound loosely, then stressed by jacks.

Prestressing arrangement is seen, with form removed to show jacks.



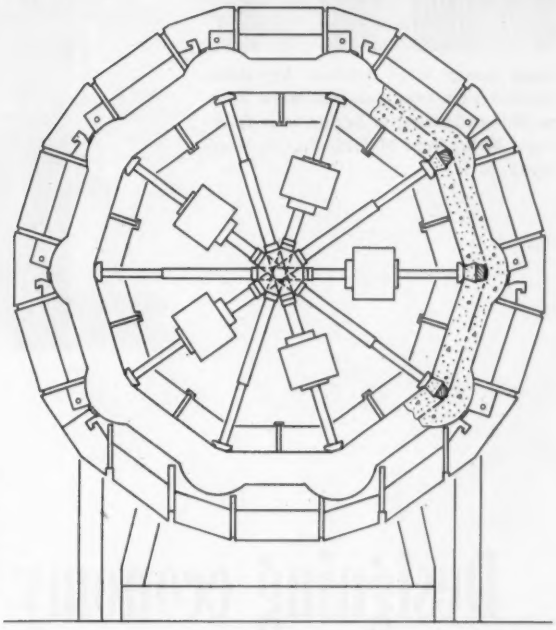


**FIG. 1. Tensioning for prestressed pipe is done by expanding hydraulic jacks against wire wound over longitudinal reinforcement.**

the pipe wall, contrary to the case of a circular pipe, and can therefore be tolerated. The tests have proved this reasoning to be perfectly sound.

The longitudinal reinforcement supports the wires and is placed in the corners of the polygon, resting on prefabricated concrete battens. The latter transfer the prestressing force from the hydraulic jacks to the wire. To find the correct stress distribution in the corner, with the interaction of forces between wire, batten, jack and, later, in situ concrete, was one of the problems to be solved.

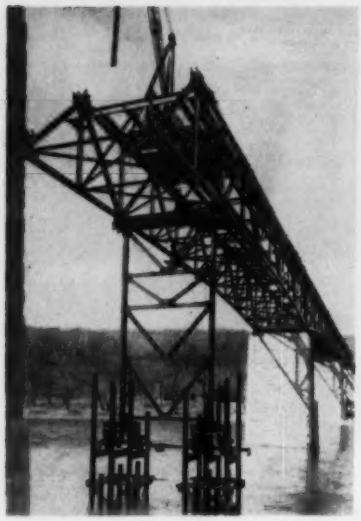
The design of a sufficiently tough, dependable and not too complicated machine for the production of these pipes was an important part of the problem. The machine must permit easy and rapid winding of the wires, exact and dependable prestressing (which must be held constant during hardening), easy placing and effective vibration of the concrete.

The machine that was designed for the work is built so that the wire can be helicoidally wound around specially shaped longitudinal reinforcing, using a braking force of only 200 lb, to give uniformity. Tensioning is done by expanding 20-ton hydraulic jacks radially against the wire. The interior forms slide on the steel supports for the battens during tensioning of the jacks. Exterior forms are attached as concreting proceeds. The frame is not rotated during concreting. The concrete is placed by hand, then vibrated and revibrated to assure a dense, watertight and strong material.

With different forms, various sizes of pipe can be made on one machine. Wire sizes can also be varied, diameters of 0.12, 0.16 and 0.20 in. having been used. In the experimental work, three men performed all the operations necessary to produce a 15-ft length of pipe in four hours.

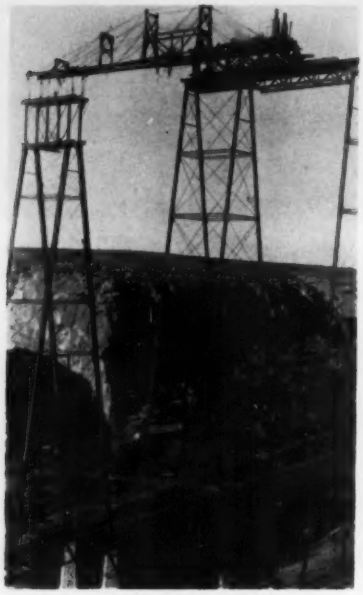
The ends of the pipe sections are made circular on the outside, so that the same kind of joints as for other prestressed pipes can be used here. An interesting future possibility for this design is jointless pipe. It is possible to have the machine working in situ, with one leg in the already completed pipe. Continuous longitudinal prestressing is easily introduced into this design, in both prefabricated and in situ pipe.

The development work here described was carried out in Oslo under the direction of the writer. It was financed by the Norwegian Government, Christian Portland Cement Co., and the contractor Berntsen and Boe A/S.

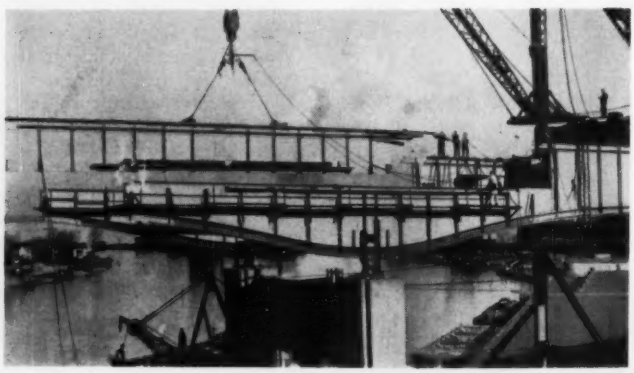


Truss spans were erected by semi-cantilevering over one falsework bent, on Milford-Montague Bridge over Delaware River, from Milford, Pa., to Montague, N. J.

Old-type traveler erects the Pecos River Railroad Bridge in Texas, 1891.



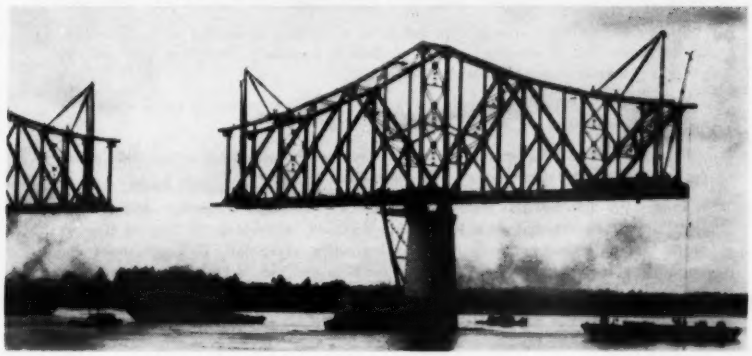
# Designing economy into bridge erection



Deep-haunch girder, with horizontal splice, was used in Fuhrmann Boulevard Bridge, Buffalo, N. Y.

Extensive falsework was required for erection of girder spans on Quinnipiac River Bridge, New Haven, Conn.

Balanced cantilever erection was used for Mississippi River Bridge at Baton Rouge, La. See article by Mr. Durkee, "Civil Engineering," March 1941, p. 153.



E. L. DURKEE, M. ASCE, Engineer of Erection, Bethlehem Steel Company, Bethlehem, Pa.

Economy in bridge erection must start with the designer's concept of the permanent structure. The problems of fabrication, transportation and field assembly must be constantly considered during the design stages to achieve the best structure at the lowest practicable cost. The ability to conceive, analyze and design a structure does not necessarily endow the creator with the ability to fabricate and erect it. It is quite possible to picture, and even to design, a structure that is impractical to build.

This does not mean that new ideas in structural design may not be economical or acceptable. Men should continue to dream and to let their imagination run a little wild now and then. Things not even dreamed of a generation ago are commonplace now. Steel can retain its competitive position only if designers, fabricators and erectors work together to plan the overall structure for the greatest total economy at a specific site.

Particularly for the more unusual and monumental structures the designer will do well to consult early with the fabricators and erectors who must deliver the end product. Such consultation is customary among the foremost consulting engineers in the country today. Out of such conferences have come many advances, not only in design but in materials of construction and methods and equipment for fabrication and erection. Such cooperation encourages development but eliminates impractical and expensive ideas before they become fixed as plans that are difficult to revise without loss of face.

While this discussion applies primarily to bridge design and erection, it is applicable to all types of steel structures. Some buildings today are completely new in their concept, and the problems involved in their fabrication and erection are exceedingly complicated and

difficult. There are innovations in ordinary tier buildings, manufacturing buildings and process industries. Many unique and complicated designs have been proposed and built for airplane hangars. Long-span structures, domes and the like, are being constructed for auditoriums and other large areas, some involving costly fabrication and difficult erection. Unless the designer can justify a more expensive type of structure, it might be well in many instances to use a more conventional and economical design instead of trying to be original.

It is probably more true for a bridge than for other steel structures that the erection method has been established by the design and the site conditions long before the steel gets to the site. The erection engineer can, by wise choice of equipment, good development of details and careful scheduling, preserve the economy that is inherent in the design and the site—but he cannot create it.

Overall economy in bridge construction ordinarily cannot be achieved by saving every possible pound of steel. Complicated detailing, difficult fabrication, unwieldy units for transport, and unusual or complicated designs of any kind can result in such higher unit costs for the total structure that weight savings are erased. Sometimes appearance justifies a more expensive type of structure; occasionally plain pioneering is worthwhile but the early planning should include consideration of the problems of the builder.

Relatively few designers have an opportunity to know bridge fabrication and construction first hand. It cannot be emphasized too often that help on this can be obtained from fabrication and erection firms. They get some return for the time spent with designers on such projects by knowing in advance about projects on which bids are to be taken soon and are pleased to do it as a service to their profession.

### Types of bridges and their erection

Highway bridge design has changed radically within the past few years because of requirements for long, straight roads with minimum grades, as demanded by the public. This has resulted in high crossings, on monumental and costly structures, for which money has been made available. There is relatively little new railroad bridge construction and there have been only slight changes in railroad bridge design in many years.

Public demand for a clear highway has resulted in virtual elimination of the simple through-truss span. In its place has come the deck-type span providing a clear unobstructed roadway. Where headroom is available, the deck truss can be used. Where headroom is a

## Practical suggestions for economy in design

**Time and materials saved for the fabricator and erector result in money saved for the client—an individual, an agency or the public. Listed are some proven ways of reducing overall costs of steel structures.**

Plan from the start for economical construction, not just for economy in materials alone. Ask for ideas from fabricators and erectors early in the design stage.

Permit the fabricator to complete the details of connections—and accept his ideas if they are structurally adequate. Changes from the original plan should be allowed as long as they do not alter the appearance, or detract from the strength of the structure.

Keep members stiff enough for handling. Reducing permanent steel on the top flanges of girders to the point where elaborate temporary provisions must be made for shipping and erection may result in a higher total cost. Consult your fabricator.

Splice points in continuous girders should be considered in relation to the falsework, or the possibility of erection without it. This is especially important over railway yards, or anywhere that falsework is expensive.

Keep splices compact and simple. In the long run, little money is saved when it is necessary to handle long, flapping splice members.

Permit the erector to vary the location and number of splices to suit fabrication needs and economical arrangement of falsework.

Specify the accuracy you want in holes and alignment. Be clear, fair and definite. Then leave it to the contractor to get that accuracy, whether by drilling to templet, or by drilling or subpunching and reaming while assembled. Different shops can achieve the needed accuracy by different methods and should be permitted to do so.

Do not specify a full-size hole in one member and subpunching in the matching member. The reamer will center itself in the small hole and chew out a side of the larger one.

Double-check the overall economy of shear connectors on the top flanges of stringers or girders. Shear connectors are a hazard to workmen and interfere with the operation of erection travelers and the movement of steel out onto the span. From the erection viewpoint, shear connectors are best added after erection. A saving in weight can be achieved but a true estimate of total cost in place must include extra engineering design, higher fabrication cost and troublesome erection.

Avoid the necessity for erection equipment of excessively large capacity to place only a few pieces in a structure. Wide roadways on conventional floor beams and stringers, in a design using only two main girders, result in two excessively heavy members per span. Consider lighter girders spaced 6 to 8 ft apart. Total weight will be similar and erection equipment can be lighter and faster; hence a comparative design and cost estimate may be desirable.

For greatest erection economy, and probably for lowest cost to the owner, avoid an unusual or trick design for a structure of any kind unless it has some special advantage beyond exhibiting the designer's ingenuity. The designer should seek for simplicity in design rather than elaborate concepts involving expensive materials and fabrication procedures, to be followed by difficult erection.

Design for as much duplication as practicable in members and in spans.

Know the tolerances that are economically practicable in the rolling and fabrication of steel. Especially for buildings, accept these tolerances and provide for any additional accuracy needed, in the connections or by varying the thickness of other materials.

When cantilevering is a probable method of erection, include the weight of the erection equipment and the method of erection in the design of the structure. Otherwise the erector must add his redesign and strengthening costs, and the engineer must add time for checking the design, all paid by the owner. Ask a fabricator for help on equipment planning—and state on the stress sheet the allowances made.

Design the structure so that all the steelwork can be completed as a continuous operation, making it unnecessary for the steel men to return for final riveting or other operations after the deck is in place.

Allow the fabricator and erector adequate time for estimating. A study of several methods of erection to determine the most economic combination of fabrication and field work takes time but reduces the cost to the owner.

problem, long-span deck girders are a frequent answer. A few years ago a plate girder over 120 ft long was unusual. Today such a girder is commonplace, made lighter and less expensive by being designed as continuous, perhaps with a composite-type deck.

Continuous girders of 387-ft clear span have been constructed in this country; longer ones are contemplated here and much longer ones have been built abroad (see article by Roman Wolchuk, A.M. ASCE, CIVIL ENGINEERING, February 1959, Vol. p. 74). The composite type of construction utilizes the concrete slab as part of the top or compression chord of a beam or girder. Orthotropic design utilizes a steel deck that is part of the working steel of the structure.

These designs result in a saving in top-flange steel but produce members much more susceptible to lateral buckling. The erector has had to introduce falsework for the erection of long girders, splicing them and erecting them in sections. For the longer, more slender spans, a stiffening beam or even a truss may be needed to brace the top flange laterally, and a spreader beam may be used for handling to reduce bending stresses during erection.

### Transport of materials

The method of shipping, handling and delivering major bridge members greatly affects overall bridge economy as it definitely determines the largest, heaviest and longest pieces that can be fabricated. The erector advises the fabricator as to his limitations and both must keep within the limits of the railways for shipping and of the trucker and his equipment for hauling.

Railroads have weight and length limits as well as a definite clearance for material loaded on cars. Erectors can help designers with special problems, and railway specialists can advise on deep-well cars and special routing that may help make a design economical. Unusually long or extra-heavy members involve extra freight charges for both weight and length where they must be handled in yards by railroads or transported from railroad cars to lighters or other water equipment.

Trucking out of plants, on the highway and to the bridge site, encounters the same problems. Sometimes there are restrictions on oversize loads involving overhead wires, escorts, and hours of travel even when permits can be obtained. By keeping these considerations in mind the designer can limit the use of outsize members to the few times they give overall economy.

Derricks, travelers and other equipment for erection have developed along with changes in design. The early viaduct type of railway bridge led to the development of the overhead gantry type of erection traveler with an extended cantilever frame and many sets of fixed falls. The bridge members were brought out on the deck, taken through the traveler by picking up from the overhead framework and "telegraphing" ahead by transferring the load from one set of falls to another.

### Erection methods

A few years ago the heaviest derricks used in bridge erection had capacity of 50 to 75 tons. Derricks of 85-ton capacity were used to erect the towers of the monumental George Washington and Golden Gate bridges. For modern turnpike construction, with its longer and heavier girder spans, still larger equipment is needed. Stiff-leg derricks with a capacity of 100 to 125 tons and reaches of 60 to 75 ft are now common; derricks with a capacity up to 183 tons have been built for bridge erection.

Truck and crawler-type cranes are now available with capacities up to 80 tons or more at small radius and with short booms. For light loads and high reaches, booms of 150 ft and longer are common, together with long jib extensions. Where bridges and other structures can be erected by cranes working from the ground beneath, very economical erection costs can be obtained.

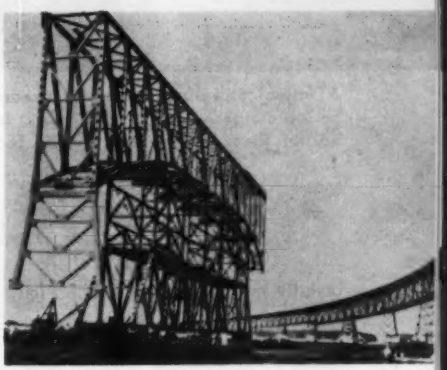
Truss-type bridges are generally the simplest and most economical to erect, whether they are of simple-span, continuous or cantilever-type construction. Since truss members ordinarily are lighter than girder sections, lighter erection equipment can be used. Cantilever erection over falsework bents and intermediate piers is fast and economical. Occasionally, on a large structure, balanced cantilever erection is used, as shown in an accompanying photo.

The longer spans of heavier girders, particularly those of the continuous type, must be spliced. This usually is done at points of minimum moment and not over the piers, a consideration that introduces the necessity for falsework. For the high spans that are now so common, this can be a considerable expense. Continuous girder spans are generally made deeper over the piers, to reduce the flange stress. In the longer spans these haunch sections sometimes are so deep that a horizontal splice must be introduced for handling and transporting, requiring additional assembly in the field.

The long spans reduce the number of piers and may possibly be economical. However, the need for heavy erection equipment and expensive falsework adds to the total cost of a project, and should be considered by the designer.

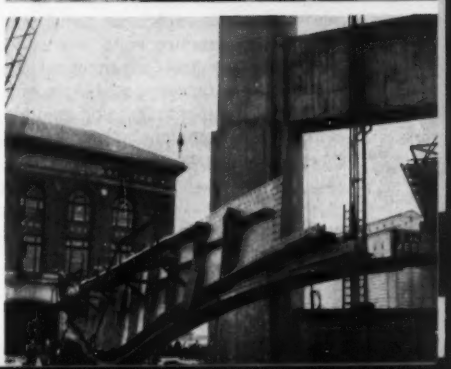
Truck or crawler-type cranes work-

**A girder 208 ft long closes the 348-ft main span of the Fuhrmann Boulevard Bridge, Buffalo, N. Y.**



**Truss span on falsework is floated in on barges for Chesapeake Bay Bridge, Annapolis to Sandy Point, Md.**

**Two girder splices are contrasted. Short, compact girder splice of Shavertown (N. Y.) Bridge over East Branch of Delaware River is seen below, and at bottom, long, complicated splice in Fuhrmann Boulevard Bridge, Buffalo, N. Y.**



**A lateral stiffening truss was needed on top flange of a girder 262 ft long for Raritan River Bridge, Perth Amboy, N. J.**

ing on the ground can economically erect beam-and-girder bridges of maximum heights up to about 80 ft. Frequently cranes are mounted on barges for the erection of such spans over rivers. For higher bridges and for most spans over water, a unit working on the deck of the structure is generally used. Usually this is a stiff-leg type of derrick. When mounted on skids or wheels so that it can move, the derrick is known as an erection traveler, or simply as a traveler. The stiff legs are usually of unequal length, the one to the rear being made longer to give increased capacity for handling loads well out ahead in the structure. This is particularly needed for girder spans where heavy members must be set at long reaches.

In deep truss spans the derrick can be mounted on a tower to provide additional vertical reach with a shorter boom. This type of traveler has been used in the erection of cantilever-type bridges having a considerable depth over the main piers. Sometimes a stiff-leg derrick on a tower is used on a barge for the erection of steel high over water.

Steel for truss spans generally is fabricated with the chords in two-panel lengths. In erection it is supported on falsework spaced two panels apart. In the past it has been customary to use falsework under each main panel point but present practice is to use as few falsework supports as practical and cantilever as far as possible between them. This semi-cantilevering results in considerable economy of falsework, especially if the structure is high or over soft ground.

A series of continuous spans can frequently be erected by full cantilevering without the use of any falsework. For a cantilever bridge, the anchor arms are usually erected on falsework by semi-cantilevering. The main span is then cantilevered for its full length, working from the two sides without falsework, and joined at the center. (See article on Greater New Orleans Bridge, by O. F. Sorgenfrei, M. ASCE, CIVIL ENGINEERING, June 1958, vol. p. 432).

Occasionally conditions are such that falsework is impractical because of deep water and soft bottom. A scheme known as "balanced cantilevering" may be used, in which erection starts on one or more piers and the structure is erected by cantilevering simultaneously in both directions, keeping the loads properly balanced to maintain stability. One of the best examples of this method is the Baton Rouge Bridge over the Mississippi, where the five-span continuous structure was built by balancing loads on the four main piers. A series of simple spans can frequently be erected by partial cantilevering after the first span is complete. This is done by tying each successive span back to the preceding one, which makes them temporarily continuous over the piers. In all such cases erection stresses will govern the size of many members, and the consulting engineer should design the structure to take account of erection stresses.

Floating an assembled span to position is another method of erecting steel over deep water where falsework is expensive or impractical. The span is built in shallow water, where falsework is economical, or directly on barges at a location where erection is practicable, considering the equipment available. The entire span is floated on the barges to its final location and lowered onto its permanent supports. Lowering and raising the barges is done by flooding with water, then pumping it out, or by taking advantage of tidal movement. This is one of the most spectacular methods of erection, rivaling cantilevering. Both are quite practical and safe with proper engineering supervision and safeguards. Under many conditions they may be the fastest and most economical methods.

### Estimating erection costs

There is no magic average price per ton that can be used to estimate the cost of different types of structures. Estimating involves an exact quantity survey, with all materials properly classified for itemized pricing of steel cost, time and labor. Fabrication costs vary with the amount and kind of work to be done, not simply with the tonnage involved. The average cost per ton comes properly from the accurate analysis of the component parts of the structure, not from an average estimate or guess of the overall cost. Such figures can very profitably be compared with the cost of previous work of a similar character to assure that there has been no gross error.

Erection costs are similarly estimated, using a quantity survey showing the total weight and number of pieces of various kinds. Such a survey shows the bulkiest and heaviest pieces to be handled, the number of rivets to be driven and bolts to be placed, the amount of field welding and any special field work required. It includes the price of the falsework in place, with a charge for material less any salvage value. From these data the estimator can determine the erection equipment and number of men required to complete the work within the scheduled time. The number of pieces or tons that can be erected per day by one gang with one erection derrick is well known, and is the main factor in determining the time required for a job.

The length of time required on a job is dependent primarily on three items: (1) the time needed to get the equipment to the site and set up in working order; (2) the time required for actual erection of the steel; and (3) that needed for final cleanup, including finishing up of riveting and bolting, and dismantling and removal of equipment from the site.

For ordinary jobs it is not too difficult or time consuming to estimate erection time. For the larger and more monumental jobs, a considerable amount of investigation and study is required. The permanent structure must be checked for the stresses imposed by erection equipment and method of erection, and the cost of stiffening or reinforcing members where needed must be estimated. Special equipment must be designed, falsework planned and priced, transportation and the availability of personnel investigated.

To all labor costs must be added a percentage to cover various overhead items such as insurance and workmen's compensation, the use and loss of small tools and equipment, job supplies, and miscellaneous field expenses. These will total 50 percent or more of the direct labor cost.

New ideas in steel construction and improvements in methods of steel erection can best be realized by combining the efforts of designers, fabricators and erectors. Bridge engineering will advance in proportion to the amount of cooperative effort exerted by all.

*(This article is based on a paper presented by Mr. Durkee before a joint session of the Construction, Engineering Mechanics, and Structural Divisions at the ASCE Annual Convention in New York, October 1958.)*

# Performing and interpreting the field density test

MILTON B. MEISNER, J.M. ASCE, Soils Engineer, Frederic R. Harris, Inc., New York, N. Y.

As the highway program gains momentum, an increasing number of tests will be run on foundation and embankment materials to determine their acceptability. Many density tests are performed by excavating a small hole in the soil being tested and then backfilling with a uniform sand of predetermined unit weight. The field density is then obtained by computing the amount of sand poured into the hole and the weight of excavated material.

Some technicians or engineers who run this density test are not aware of the magnitude and possible causes of fluctuation in the density of the reference sand. These fluctuations can cause errors of up to 10 percent in the modified AASHO density or 70 percent in the relative density. This in turn may involve costly delays in construction if an area is rejected because of a faulty test on an acceptable foundation. On the other hand an error in testing may result in the acceptance of a weak foundation which will involve high maintenance costs.

Two methods of performing the field density test are illustrated in Fig. 1, the jar-with-cone method and the open-cone method. The former is now the more popular procedure in the United States; however the latter was used on airbase construction in French Morocco 1951-1954.

Results of a series of tests run by varying the height of sand in the open cone are presented in Fig. 2. This, in effect, means varying the speed with which the density hole is filled with sand. The more slowly the sand is poured into the container, the greater is the opportunity for it to roll into a more dense position and consequently the greater will be its density.

Similar results were obtained when the valve opening was varied in the jar-with-cone apparatus, as shown in Table I.

Ottawa sand was used in the series of tests reported in Table I, whereas a medium uniform sand made from a locally available material was used in the series of tests plotted in Fig. 2.

When running a field density test by the jar-and-cone method, the volume of the cone is subtracted from the total volume measured. Therefore the possible error can be greater than that given in Table I. For example, discrepancies in the reference density have occurred because of failure to open the valve completely, or because a small piece of gravel was lodged in the orifice. Either of these conditions will cause the sand to flow more slowly and consequently the resulting density will be higher than when the valve opening is not constricted. Therefore, more sand will fill the hole as well as the cone.

Let

$W$ = weight of sand in hole if there is no error in the reference-sand density

$X$ = additional sand in hole due to an error in density

$T$ = weight of sand required to fill cone if there is no error ($T$ equals $W$ in this example.)

$W_T$ = total sand used to fill hole

If the volume of the hole is the same as that of the cone, then

$$(W + X) + (T + X) - T = W_T$$

$$W + T + 2X - T = W_T$$

$W_T - W = 2X$, the excess sand used if there is an error in the density of the reference sand.

This discrepancy, $2X$, is double that given in Table I. If the density hole is smaller than the cone, the error will become even greater. Therefore the hole should be made larger than the volume of the cone, preferably about twice the size.

Another source of error is vibration. A discrepancy of 10 percent or greater can be caused by accidentally hitting the jar before the valve is closed. Equipment working nearby can cause errors of the same magnitude. The effect of vibrations due to equipment can be observed by placing some of the density sand on a natural slope in a container

**TABLE I. Differences in density obtained by varying valve opening**

| Test No. | Density, pcf | Valve Opening | % Discrepancy |
|---|---|---|---|
| 1 | 96.9 | Full | 0 |
| 2 | 99.1 | ⅛ | 2.3 |
| 3 | 101.5 | ⅛ | 4.7 |

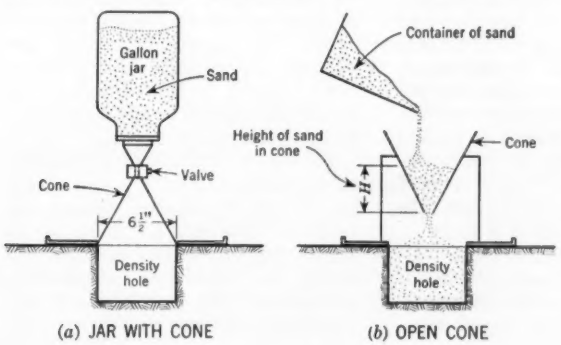



**FIG. 1. Two methods of performing the field density test are illustrated.**

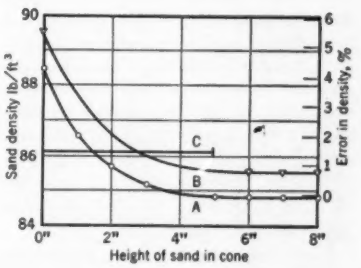



**FIG. 2. Sand density is plotted against height of sand in cone. For Curve A, excess sand was cleared away rapidly with a straightedge. For Curve B, the excess sand was cleared away at one-third the speed for Curve A. For Curve C, the sand height varied between zero and 5 in.**

near the density hole and noting any subsidence or movement of particles during the performance of the density test. A tight or rusty valve may cause vibrations when an attempt is made to open or close it. The valve should be in good repair before the test is started.

When a density test is run on fine grained soils, a piece of gravel may be encountered. The practice of placing the gravel back in the hole is not recommended. A popular method of correcting the density is by subtracting the volume and weight of the gravel, using the bulk specific gravity of the gravel in computing its volume. (See Procedures for Testing Soils Sponsored by A.S.T.M. Committee D-18, "Suggested Method of Test—for Density of Materials in Place," by R. J. Hank.)

This method is satisfactory for gravel contents of less than 30 percent. Above this amount the voids contributed by the gravel become appreciable. The compaction characteristics may change considerably as well. Professor D. M. Burmister, M. ASCE, of Columbia University, has shown the effect on maximum densities of variations in the range of grain sizes, the type of the gradation curve, and the grain shape ("The Importance and Practical Use of Relative Density in Soils Mechanics," A.S.T.M. vol. 48, 1948, Fig. 12). Also, the U. S. Bureau of Reclamation has run tests showing the effect of rock content on density ("Control of Embankment Material by Laboratory Testing," F. C. Walker and W. G. Holtz, Members ASCE, *Transactions* of ASCE, vol. 118, 1953).

The gradation of the material and the grain shape are very important in determining relative density or percentage of compaction. Each field density determination should be accompanied by a statement of the gradation of the material extracted from the hole. This gradation should be used in determining the maximum and minimum unit weights. If the density has been determined for a different gradation, it must be adjusted to reflect the material from the density hole. Taking a sample adjacent to a density hole is a method frequently employed in determining the grain size distribution. This procedure, however, can lead to errors of large magnitude where segregation has occurred.

Thus it is seen that there are several possible sources of error in running the field density test. These errors can be avoided by running the test carefully. However, if it is to be a meaningful and permanent record that can be related to the later behavior of the structure, the test must be performed by experienced personnel who are familiar with the principles discussed here.



# Sealing the Casagrande piezometer

**T. WILLIAM LAMBE, M. ASCE,** Assoc. Prof. and Head, Soil Engineering Div., Dept. of Civil and Sanitary Engineering, Mass. Inst. of Technology, Cambridge

A new technique has been developed which reduces the work and saves time in sealing the Casagrande piezometer for measuring pore-water pressures. This technique employs a water-sensitive gel, as here described. On Boston's Logan Airport, A. Casagrande, M. ASCE, in 1949 developed a porous-tube piezometer sensitive enough to give reliable measurements of water pressures in the pores of the foundation clay. Casagrande described in detail the method of installing his piezometer in "Soil Mechanics and the Design and Construction of the Logan Airport," *Journal* of the Boston Society of Civil Engineers, Vol. 36, No. 2, April 1949.

Extensive use of the Casagrande piezometer since 1949 has proved it to be thoroughly dependable, but it has the drawback that considerable effort is required to install, and especially to seal it. Approximately 10 man-hours are required to form and place the bentonite balls of ⅜-in. diameter needed to seal a piezometer in a 2-in. casing, and approximately 40 man-hours for one in a 4-in. casing. (The 4-in. casing is often used so that two lines can be run to the porous tube to permit flushing.)

In an effort to reduce the work of sealing the piezometer, J. P. Collins, an assistant to the writer, built a device that extruded a bentonite rope of ⅜-in. diameter. The rope was then cut with a wire saw into cylinders ⅜ in. long. This technique shortened the time required to prepare the bentonite chunks.

An even quicker method of sealing the piezometer was then suggested by the writer and developed by Collins. This new technique employs a clay-chemical grout first proposed by the writer in 1951 for impermeabilizing soils. The chemical, now manufactured by the American Cyanamid Company, is marketed as AM-9. A mixture of AM-9, water and suitable catalysts will polymerize to form a water-sensitive gel. Tests by the American Cyanamid Company have shown no disintegration or volume change from syneresis of gels kept in contact with water. The maximum test duration is 5 years.

In the gel method of piezometer sealing, a 1-in. layer of bentonite seal is first placed, as specified by Casagrande. (This seal prevents the clay-chemical mix from invading the sand around the porous point.) Then a predetermined amount of slurry of clay and catalyzed chemical is poured in. Polymerization occurs in an elapsed time of 15 minutes at an ambient temperature of 85 deg F, or 40 minutes at an ambient temperature of 60 deg F, to give a strong, rubbery, impermeable seal. This seal can be prepared and installed, in either a 2-in. or a 4-in. casing, in a couple of hours. If the ingredients have been preweighed and premixed, a seal can be placed in less than an hour.

A simple laboratory test was performed to compare the gel and the bentonite seals. Each type of seal was placed according to specifications in a piezometer casing around a saran piezometer tube and then subjected to 50 psi of water pressure. At the end of 7 days for the bentonite, and 3 days for the gel, no water could be forced into the casing. The bentonite required more time since it is more compressible than the gel, that is, the balls must deform to give a homogeneous mass. At the end of this adjustment time both seals were performing properly. Both seals were then extruded from their pipes. A force of 135 lb was required to push the bentonite seal out and one of 1,200 lb to remove the gel seal. The gel method is now being used by the Creole Petroleum Corp. in installing piezometers at La Salina, Venezuela.

Although almost any local, natural clay can be used in the chemical slurry, certain soils contain trace elements that can speed, retard, or prevent reaction. To avoid this problem, pure kaolinite is being used at the La Salina installation. A set of step-by-step instructions for the preparation and installation of the kaolinite and AM-9 seal has been prepared and can be obtained from the writer. The ingredients can be preweighed and premixed in the laboratory, so that all the field man need do to prepare the slurry is to mix the contents of two containers with water.

The cost of chemicals for a gel seal in a 2-in. casing is $1 and in a 4-in. casing, $4. If there is sufficient demand, the American Cyanamid Company (or its agent) may furnish two packages containing the preweighed and premixed chemical and clay needed for the sealing of a piezometer.

# THE READERS WRITE

## Facilities needed for rapid transit by bus

To the Editor: A great deal can be done economically to improve and encourage greater use of public transportation. Just a fraction of the billions of dollars being spent for limited-access highways, channeled into facilities for rapid transit, can greatly reduce the need and desire for the use of private cars.

A little is being done. A rapid-transit rail line has been placed in the median strip of the Congress Street Expressway in Chicago with stations and access at principal cross arteries. To be economical such a rail line must serve a heavily populated area. The U. S. Government has so far refused to participate in financing such rail lines.

The urban bus is taking over many of the functions of the rapid-transit rail line. Such buses should be encouraged by provisions for operation on expressways with safe stations for loading and unloading passengers and for interchange with intersecting transportation.

The U.S. Bureau of Public Roads will participate up to 90 percent in the cost of bus facilities on the Interstate System so long as such facilities are at interchanges and apart from the through lanes of the expressway. Cities such as Los Angeles, St. Louis, Detroit, Chicago and San Antonio have already created or are planning to install bus stops on their expressways. California, a pioneer in bus operation, now has an amendment to its street and highway code that provides for the state to pay a share of the cost of bus stops on limited-access highways.

No one would think of planning a rapid-transit rail line without station stops, and since a bus line on an expressway has similar work to perform, it follows that it should be given the same facilities, modified to suit the bus type of transportation.

While the rapid-transit rail line, operating on its own right-of-way, can move a larger number of people in a shorter time than a bus line, the bus has many advantages over the rail line:

1. The bus is very flexible in operation; it can leave or enter the expressway at any interchange to terminate at some distant community, thereby acting as its own feeder.

2. Bus routes can be altered and transportation units varied as the need arises.

3. The bus is not handicapped by high maintenance charges, for keeping up the roadbed and signal system, etc., as the rail line is.

4. The bus can be made to pay in an area with small patronage, where a rail line would lose money.

5. The bus can bypass obstacles where necessary.

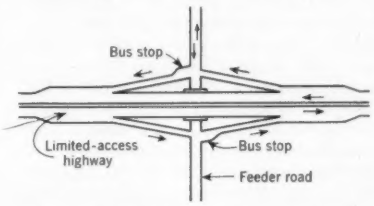
No arrangement for public transportation is currently being made on most limited-access highways. Buses that wish to discharge or take on passengers must leave the expressway. In returning to the expressway to continue their journey, buses are often handicapped by the design of the interchange, which makes no provision for such a maneuver.

Just as station stops on a railroad gave impetus to the construction of villages and then towns around them, the modern interchange on the limited-access highway is creating a similar pattern.

Most interchanges are located at important crossroads or streets where public transportation is already in existence or soon will be. It is necessary to provide an opportunity for buses on the expressway to exchange passengers with these cross lines. It is important that the design of an interchange allow buses to stop, discharge and take on passengers.

At present buses operating on an expressway often leave it for exchange of passengers in a nearby town thereby losing considerable time. It is far more desirable to have local passengers moved to the expressway bus stop by local public transportation, taxi cabs or private cars. This is the pattern used by rail commuters for many years, but it must be made rapid and convenient. Adjacent parking space must be provided also, to make bus transport sufficiently attractive to the motorist to keep his car out of town.

The clover-leaf interchange, or some modification of it, has been a favorite design with planners of limited-access highways. It is used primarily to avoid left-hand turns; it requires a large area and creates much waste space inside the several circular loops for the ramps. For many locations a simple diamond-shape interchange (see sketch) is adequate. It




is more favorable for bus operation; it eliminates left turns on the expressway but permits them on the cross street.

There is a popular saying that, "We now have a new national flower, the concrete clover-leaf." Let us discourage the spread of these flowers so that they will not monopolize the countryside.

The next step in speeding bus transportation and making it more attractive may be segregated bus lanes on the expressways, arranged so that other vehicles cannot intrude. This is recognized in such cities as Los Angeles and Chicago. The proposed Southwest Freeway in Chicago is to have lanes exclusively for the use of buses. Perhaps we must wait until the day arrives when this need is generally recognized, for real progress in this means of improving public transportation. Meanwhile buses must operate with other vehicles on the expressway. Certainly arrangements should be made for buses to stop, exchange passengers, and continue their journey.

Why are we spending billions of dollars on limited-access highways? Is it for the benefit of the individual motorist or to move the greatest number of people in a given time? It would seem that the public carrier should have the preference, wherever possible. The public carrier, in most instances, is the BUS.

Charles Elcock, M. ASCE
*Consulting Engineer*

*Philadelphia, Pa.*

## Full professional status—not through degrees alone

To the Editor: Mr. Israel Light, in his letter to the editor in the January issue (vol. p. 33), makes several comments concerning the present public attitude toward professional recognition of engineers.

He says that the public today is more concerned with the possession of a degree or title than with the manner in which the degree or title has been obtained. He also points out that stricter professional licensing requirements will not make engineers "professionals" in the eyes of the public—at least not to the same extent as will the possession of an advanced degree. In his closing remarks, Mr. Light seems to urge engineers who are perplexed as to how to become recognized as "professional" to solve the problem by gaining advanced degrees, thereby becoming "professional" in the eyes of the public.

Does this really make engineers professionals? I contend it does not! We, as engineers, can pull the wool over the public's eyes for the present by offering them what they seemingly want—bigger and better degrees. But what will we do when, in years to come, the master's degree is as common as the bachelor's degree is today? Can we ever gain true and lasting professional status merely by keeping one degree ahead of everyone else? Certainly no sound professional status can ever be developed in a race to keep one degree-step ahead of those in other fields.

The best way to gain lasting professional recognition is to do as other professional groups do—meet special and specific experience requirements, plus, may I add, passing a series of comprehensive written examinations. Mr. Light's statement that anyone, relatively speak-

ing, can get a bachelor's degree should be extended to include the master's degree as well. Professional licensing requirements are far more standard than degree requirements. As Mr. Light would point out, the public does not recognize this. But other professional groups do! And it is with these other professional groups that engineers must first gain full stature. The public's acceptance will soon follow.

Recognition on a professional level through these means will not come overnight, but it will come in time, and that is better than never being called "professional" by those persons who hold the position in society we would like to share.

DUANE W. BUTLER, J.M. ASCE
*Asst. Sanitary Engr., Water Supply and Water Pollution Control Program, U.S. Public Health Service*

*Washington, D.C.*

## Solving bridge geometrics by computer

TO THE EDITOR: Mr. Jack Belzer's article in the May 1958 issue, "Solving Bridge Geometrics by Computer," is a pioneer approach to the solution of a difficult problem, namely, the intersection of a straight line with a parallel spiral. But the precision of the final results is questionable since it is based on the approximate equation, $y = Ks^3$, which assumes $\sin \alpha = \alpha$.

Also, Mr. Belzer appears to give a double meaning to the angle $\alpha$. In Fig. 1, it represents both the total central angle of the spiral arc BC and an angle of the differential triangle whose tangent is $dy/dx$. To avoid confusion, let us imagine this angle at C to be called $\alpha_s$ (the familiar "spiral angle"), while $\alpha$ is at any intermediate point P. Then $\alpha$ is a variable angle subtended by arc BP and $\alpha_s$ is the constant angle subtended by arc BC.

Attention is here called to the simple expressions:

$$\alpha = \alpha_s \left(\frac{s}{L}\right)^2; \quad L = 200\,\alpha_s/D; \quad 1/R = 2\,\alpha_s/L;$$

where $D$ is the degree of curve of radius $R$. It is suggested that a simpler and more accurate procedure be substituted for Eqs. 1, 2, 2*b*, 3, 4, 5, and 7.

The coordinates $y$ and $x$ of the centerline spiral are correctly given by the expressions:

$$y = s\left[\frac{1}{3}\alpha_s\left(\frac{s}{L}\right)^2 - \frac{1}{42}\alpha_s^3\left(\frac{s}{L}\right)^6 + \frac{1}{1{,}320}\alpha_s^5\left(\frac{s}{L}\right)^{10} - \dots\right];$$

$$x = s\left[1 - \frac{1}{10}\alpha_s^2\left(\frac{s}{L}\right)^4 + \frac{1}{216}\alpha_s^4\left(\frac{s}{L}\right)^8 - \frac{1}{9{,}360}\alpha_s^6\left(\frac{s}{L}\right)^{12} + \dots\right];$$

which are rapidly convergent, so much so that the last terms may be neglected.

The writer examined this paper critically only after reading Mr. Kelly's discussion in the January 1959 issue (vol. p. 34).

T. F. HICKERSON, M. ASCE
*Formerly Prof. of Civil Eng., Univ. of North Carolina*

*Chapel Hill, N. C.*

## Plug-in formula gets a big plug

TO THE EDITOR: Palto Collins in his letter in the February issue, vol. p. 104, makes two points that seem to me doubtful regarding Mr. Tanner's proposal to use "Traverse Closure as a Mathematical Method" (Nov. issue, vol. p. 856).

First he states that Mr. Tanner's problem is neither difficult nor unusual and can be solved in about five steps. Everyone will agree that the problem is neither difficult nor unusual. It is so usual that a person may be called upon to solve it several times a day, as I did twenty-odd years ago on land acquisition work. But Mr. Collins then proposes what is probably the hardest conceivable way to solve the problem. There is no comparison between the method described by Mr. Tanner and that described by Mr. Collins as regards quantity of work involved or orderliness of procedure. And undoubtedly Mr. Tanner sent in his article so that other people could learn this rapid and clean-cut method of solving intersection problems.

The second point advanced by Mr. Collins is to the effect that traverses take many shapes and the use of "plug-in" formulas is not generally desirable. The fact that traverses take many shapes in an argument for the method described by Mr. Tanner because it is universally applicable to plane traverses. Furthermore it is a "plug-in" formula that enables the computer to show all his work on a traverse sheet, and then to use the same sheet to compute areas or offsets or whatever other extended computations may be in prospect. The identical method was standard practice in our Corps of Engineers office at Rock Island, Ill., in 1937-1939. We were then and I am still of the opinion that the use of this plug-in formula is a very desirable practice.

WILLIAM A. WHITE, A.M. ASCE
*Executive Director, Calif. Council of Civil Engrs. and Land Surveyors*

*Sacramento, Calif.*

TO THE EDITOR: Reference is made to the article in the November issue by John F. Tanner, "Traverse Closure as a Mathematical Method," and to Mr. Collins' comments in the February issue.

Mr. Collins' unfortunate reference to the closure formula as a "plug-in" formula can only prompt me to suggest a careful examination of the law of sines, law of cosines, or any other well known trigonometric rule in its algebraic form. Are they not also "plug-in" formulas? The closure formula is one of the most useful shortcuts devised for the solution of a two-unknown problem of this type.

Point by point, I can only agree with Mr. Collins that the closure problem is not a difficult one, but it is certainly time consuming by the method he advocates. Why should five steps be used when two will suffice? Furthermore, the solution of a problem of this type using the law of sines is not only more time consuming, but is less accurate. This has been shown through years of experience by the California Division of Highways, which has long advocated the use of the closure formula in right-of-way computations and design. Consistent closures can be obtained on a traverse closing on the point of beginning, to within 0.001 on the strong side and 0.003 on the weak side of a traverse, by carrying functions to 7 or 8 decimal places and distances to 3 places. By the use of the law of sines no such consistent results are obtainable. Admittedly if the formula is used in vector analysis or other analogous problems, such a degree of accuracy would be superfluous. However, in a traverse it can become a matter of importance.

An illustration of the use of the closure formula and its derivation may be found in a booklet by the writer, "Machine Methods of Survey Computing by the Coordinate Method," copyright 1958.

E. R. FISK, A.M. ASCE
*Engr., Bechtel Corp.*

*Vernon, Calif.*

## Michigan's evaporation losses also high

TO THE EDITOR: Never one to belittle the misfortunes of others, Michigan cannot forbear crying "me too" at the announcement of annual evaporation losses of 21 million acre-ft in 17 Midwestern states (in the column "Do You Know That," December issue, p. 43).

Michigan, the "Water Wonderland" state, totals up only some 10 to 12 inches of annual runoff from its 31 odd inches of annual precipitation. The rest goes up in evaporation which, even from its 57,022 sq miles of land area, figures more than 50 million acre-ft any way you slice it—more than twice the cited loss from the 17 brawny Western states together. If that loss was intended to refer only to reservoir areas, even a modestly assumed 12 in. of annual evaporation from our 25+ million acres of inland water surface may entitle us to a tattered corner of the crying towel.

MILTON P. ADAMS, M. ASCE
*Exec. Secretary, State Water Resources Commission*

*Lansing, Mich.*

## How should concrete be waterproofed in cold climates?

TO THE EDITOR: In Mr. Gill's article in the January issue, "Waterproofing Buildings Below Grade," typical details were given of a combination of hydrolithic and membrane waterproofing for a deep basement. In Fig. 1 (vol. p. 4) the hydrolithic waterproofing is shown as applied to the inside face of the basement wall. It seems

to me that this may do more harm than good in the upper portions of the wall in cold climates where the freezing of water will result in concrete disintegration.

I do not know of any solution except the obvious one of placing the hydrolithic material on the exterior face of the wall only. I would appreciate any comments on this problem.

I. G. Forbes, A.M. ASCE
*Asst. Engr. of Buildings*
*Illinois Central Railroad*
*Chicago, Ill.*

## Author's reply

To the Editor: The condition to which Mr. Forbes refers is a possibility. It is characteristic of concrete exposed at the water line in hydraulic structures, with the degree of disintegration depending on the quality of the concrete. For the past thirty years I have not had the privilege of personally observing the behavior of hydrolithically waterproofed concrete exposed to severe cold climates. I hope someone with experience in this condition can comment on this point.

Grayson Gill, M. ASCE
*Architect and Engineer*
*Dallas, Texas*

## Metallic waterproofing found effective

To the Editor: The article by Mr. Gill in the January issue, "Waterproofing Buildings Below Grade," is very interesting and should stimulate discussion.

It might be stated that concrete properly designed, quality controlled and adequately placed and cured should not require waterproofing, but this utopian condition is very much the exception rather than the rule. Twenty-five years with a general contractor, as Engineer to the General Superintendent, followed by twenty years as head of my own company specializing in waterproofing and masonry restoration, has presented numerous and varied problems.

My own observation is that often both the design engineer and the specification writer follow too much what has been used for past jobs rather than spending a little thought on what is needed for the structure at hand.

Integral waterproofing can be effective if the concrete becomes impermeable and shrinkage cracks are eliminated. Such conditions are hard to attain. Membrane waterproofing offers in theory an ideal solution to leakage, but quite a few installations have proven inadequate.

Metallic (hydrolithic) waterproofing seems to be the one reliable method, with a very few possible exceptions. The following is an example.

A large four-story structure was built where ground water was only a few feet below grade. Metallic waterproofing was specified for the service tunnel, under the first floor. A good-sized transformer room was built adjacent to the building, about 12 ft below grade. Seven-ply membrane, with a poured concrete wall for protection, was specified. Soon after completion, leakage into the transformer room developed. This was repaired by applying metallic waterproofing on the interior of the walls and on the floor. Over ten years later the metallic applications in the tunnel and transformer room showed no leaks. Similar instances can be cited.

However, let us not assume that the same method can be used in every installation. A study of the conditions surrounding each project should be made.

E. C. Harding, M. ASCE
*Edward C. Harding Co.*
*Cincinnati, Ohio*

---

**AMERICAN SOCIETY OF CIVIL ENGINEERS**

# Second Jet Age Airport Conference

Air Transport Division and Houston Branch, Texas Section

**Shamrock Hilton Hotel, Houston, Tex.** **May 20-22, 1959**

The first "Jet Age Airport Conference", which was conducted by the Air Transport Division in 1957, concentrated attention on those problems that had to be solved before jet aircraft could operate from the commercial airfields of the world. Ideas exchanged at that time accelerated the work which has provided, and is providing, new and necessary facilities. To chart the gains made, and permit open appraisal of experience in the two years that have sped by since the first conference, this second "Jet Age" Conference has been planned with care.

An invitation is extended to those who, directly or indirectly, are concerned with the provision and operation of facilities to serve the high-speed, high-capacity aircraft now coming into general use. This unusual opportunity, to attend and to take part, is recommended for your attention.

Reginald J. Sutherland
*General Conference Chairman*

## Outstanding Program Planned

### A Session on Aircraft Demands of the Future

**Wednesday, May 20, 9:30 a.m.**

***Presiding: R. J. Sutherland, Conference Chairman***

**Introduction to Conference**

John M. Kyle, Jr., Chairman, Executive Committee, Air Transport Division.

**Analysis of Air Travel Demands in the Next Decade**

J. W. Pocock, Booz, Allen and Hamilton, Management Consultants, Chicago, Ill.

**Aircraft of the Future**

C. Stark Draper, Mass. Inst. of Tech., Cambridge, Mass.

**Requirements for Municipal Aircarrier Airports**

Thomas Burnard, Airport Operator's Council, Washington, D. C.

### A Session on Airport Environment in the Future

**Wednesday, May 20, 2:30 p.m.**

***Presiding: John M. Kyle, Jr., Chairman, Executive Committee, Air Transport Division.***

**Environmental Planning of Future Military Air Bases**

S. Richard Rio, U. S. Air Force, Washington, D. C.

**Integrating the Airport into Metropolitan Planning**

Marvin R. Springer, Urban Planning Consultant, Dallas, Tex.

**Ground Transport to and from the Airport —Panel Discussion**

*Moderator:* Vincent J. Roggeveen, Mass. Inst. of Technology, Cambridge, Mass.

*Participating:*

Professor Roggeveen, Ground

Transport Committee, Air Transport Association

ROBERT S. ANGSTADT, Vice President-Operations, Chicago Helicopter Airways, Inc., Chicago, Ill.

BEN E. NUNN, Parking Associates Group, Pasadena, Calif.

## A Session on VTOL-STOL Aircraft and Financing

**Thursday, May 21, 9:30 a.m.**

***Presiding: Robert J. Horonjeff, Executive Committee, Air Transport Division***

**Airport Revenue Bond Financing**

WALTER CLEAVE, Vice President, Blyth and Company, Chicago, Ill.

**Rates and Changes**

D. C. MEENAN, Vice President, United Airlines, Chicago, Ill.

**VTOL-STOL Aircraft—a Committee Report**

WILLIAM C. BORLAND, Coordinator of Engineering, Port of New York Authority; Chairman, Committee on Air Centers.

**Airports and the Traffic Control Problem**

RICHARD H. JORDAN, Director, Operations Analysis, Bureau of Research and Development, Federal Aviation Agency, Washington, D. C.

## A Session on Terminal Operation

**Thursday, May 21, 2:30 p.m.**

***Presiding: Ronald M. White, Executive Committee, Air Transport Division***

**New Facilities for Jet Aircraft Operation at Arly Field, Paris**

M. LOUIS COUHE, Paris, France.

**Experience with Jet Aircraft at Terminals —a Panel Discussion**

*Moderator:* THOMAS M. SULLIVAN, Chief, Aviation Planning, Port of New York Authority, New York, N. Y.

*Panel participants:*

American Airlines
British Overseas Airways Corporation
Eastern Airlines
National Airlines
Pan American Airlines
Trans World Airlines
United Airlines

**Runway Length Factors**

ROBERT J. HORONJEFF, Univ. of California, Berkeley, Calif.; and RICHARD E. COYKENDALL, United Airlines, San Francisco, Calif.

**Pavements for Jet Aircraft Operation—A Panel Discussion**

*Moderator:* W. J. TURNBULL, Waterways Experiment Sta., Vicksburg, Miss.

*Participating:*

O. J. PORTER, Porter, Urquhart, McCreary and O'Brien, Newark, N. J.

J. P. SALE, Airfields Branch, Office, Chief of Engineers, Washington, D. C.

E. C. MOLKE, Summers, Munninger and Molke, Albany, N. Y.

H. LICHTEFELD

## A Session on Design Criteria and Visual Guidance

**Friday, May 22, 9:30 a.m.**

***Presiding: William D. Alexander, Executive Committee, Air Transport Division***

**Development of Design Criteria for Washington International Airport Terminal facilities—Panel Discussion**

RICHARD HUBER, Project Director, Ammann and Whitney, New York, N. Y.

**Appraisal of Airport Visual Guidance—A Panel Discussion**

*Moderator:* ERNEST CUTRELL, Consultant, Federal Aviation Agency, Washington, D. C.

*Topics:*

Aircraft Guidance at Present Innovations
Research on Runway Lighting

*Participating:*

ROBERT F. GATES, National Aviation Facilities Center

JOHN F. GILL, Eastern Airlines

DAVID S. LITTLE, American Airlines

RAY STRONG, U. S. Air Force, Dow Air Force Base, Bangor, Maine.

## Unusual Entertainment

A Western-style barbeque, with refreshments and entertainment, will be held at poolside on the spacious grounds of the Shamrock-Hilton on Wednesday evening, May 20.

## Wives Have Special Invitation

With the unusual attractiveness of this Conference location, special entertainment will be offered for the wives attending.

## Send Hotel Reservation Request Now

A limited block of rooms has been reserved at the headquarters hotel, available on a first-come, first-served basis. Send requests for reservations to:

Hotel Shamrock-Hilton
P. O. Box 1287
Houston, Tex.

and mention this conference.

## Send Registration Request Now

To assure convenience to all attending this conference, a "package" registration has been provided. Advance registration is requested. The registration fee covers all events, including two luncheons and the Western Barbecue and entertainment. Checks in the total amount of $18.00 should be made payable to, and sent to:

Mr. E. C. Jancik,
Registration Chairman
4832 Kirby Drive
Houston 5, Tex.

Conference badges and event tickets will be held at the registration desk for your arrival.

## Committee for the Conference

For this joint enterprise, the Houston Branch of the Texas Section has accepted the responsibility for all local arrangements:

*Honorary Chairman:* MASON G. LOCKWOOD, Past President, ASCE

*City of Houston:* The HON. LEWIS W. CUTRER, Mayor

*Arrangements Chairman:* HERBERT M. SHILSTONE, JR.

*Reception Chairman:* ROBERT M. COLLIE, also President, Houston Branch

*Attendance Promotion Chairman:* FRANK WENDELL BEARD

*Hotel Arrangements Chairman:* HARRY E. BOVEY

*Registration and Budget Chairman:* EDWARD C. JANCIK

*Public Relations Chairman:* JOHN A. FOCHT, JR.

*Women's Entertainment:* MRS. FRANK H. NEWNAM

The Air Transport Division has accepted responsibility for the program and its coordination, with:

*General Chairman:* REGINALD J. SUTHERLAND, Secretary of the Air Transport Division

*Program Chairman:* JOHN HUGH JONES, Chairman also of the Committee on Session Programs for the Division

*Division Chairman:* JOHN M. KYLE, JR.

# SOCIETY NEWS

## Cleveland Convention Promises Memorable Program

This is a last-minute reminder that Cleveland and the Cleveland Section are doing themselves proud to assure all who attend the Society's forthcoming Convention an informative and enjoyable program. The dates are May 4-8, and the place the Sheraton-Cleveland Hotel. The expected attendance of over 1,000 will include civil engineers of all types, including those capable of designing and building refueling stations in space for airships en route to the planets.

Mayor Anthony J. Celebrezze will do the honors for the city at the Wednesday luncheon, May 6. The featured luncheon speaker will be Dr. Harvey C. Kelly, Assistant Director for Scientific Personnel and Education of the National Safety Council.

Continuing the probing into city planning matters, which were emphasized at the recent Los Angeles Convention, there will be four half-day sessions under the sponsorship of the City Planning Division. Two of the sessions will be panel discussions, in which non-engineers as well as engineers will participate—an innovation in program procedure. One panel group is composed of a shopping consultant, two directors of city planning commissions, and a Cleveland newspaper editor. They will discuss "The Public's Stake in Revitalized Public Transit." At the other panel discussion—on "Public Transit Improvement Programs"—reports on industry trends in transit improvement will be heard from Chicago, Toronto, and Cleveland.

Sessions of the Construction and Structural Divisions will delve into the very important subject of protection from accidents at new nuclear power plants as well as construction of the plants. At least a dozen papers are on the general subject of containment, or protection, at nuclear power stations.

Deep-draft navigation on the Great Lakes will be under study at sessions of the Waterways and Harbors Division. One paper will discuss the economic potential of the Great Lakes in the St. Lawrence deep-draft navigation system. Other papers are concerned with the bluff recession along Lake Erie and the geology of the Ohio shoreline of the lake.

Due attention, of course, will also be given the professional aspects of civil engineering, including engineering education. These subjects will occupy sessions of the Department of Conditions of Practice and a Student Chapter Conference.

One of the unique opportunities offered in the Cleveland Convention program will be a visit to the Lewis Research Center of the National Aeronautics and Space Administration. This trip, planned for Friday afternoon, May 8, will be of exceptional interest to persons concerned with the country's progress in the fields of flight and space travel. It will be open to United States citizens only. The names of all visitors and their affiliations must be submitted to the Research Center prior to the trip.

The Center is one of the three major research establishments operated by the National Aeronautics and Space Administration, the government's top aeronautical research organization. Some of the areas under study at the Center are combustion, fuels, propulsion system installation, engine design, controls, cooling, high-temperature materials, and lubrication. A few of its recent contributions to aeronautical science include supersonic inlets, transonic compressors, high-energy fuels, turbine cooling, turbojet afterburners, and a crash fire inerting system.

The Research Center is located on a 200-acre site adjacent to the Cleveland Hopkins Airport. Its numerous facilities include a 10 by 10-ft Supersonic Wind Tunnel. Two large air compressors, powered by seven electric motors, move air through the tunnel at speeds of 1,500 to 2,500 mph, simulating flight conditions at altitudes up to 30 miles. A closed-circuit television system permits observation of the object undergoing test. Among other facilities are the Engine Research Building, which contains about 100 test stands for investigating turbo engines, combustors, and gas turbines; the Rocket Laboratory for studying thrust-producing devices that carry their own fuel and oxidizer; and the Central Automatic Data Processing System that transmits raw data on a 24-hour basis from major facilities of the Center.

### Program in March Issue

W. R. Swatosh is chairman of the Convention, the first Society Convention held in Cleveland since 1930. The full program of technical and social events appeared in the March issue.

**Lewis 10 x 10-ft Supersonic Wind Tunnel is operated by the NASA in cooperation with industry and the armed forces for developmental testing of full-scale engines and components for high-performance aircraft. Steel air duct at right leads to the tunnel test section, housed in long, narrow structure in the center. Building at left and the one at the opposite end of the intervening steel duct house axial flow compressors, which supply the air flow. Flanking the center duct are an air dryer (top center) and an acoustic muffler (center).**

# Campaign for Funds for UEC Continues

The Member Gifts Campaign for the United Engineering Center continues steadily (if a bit too slowly) toward its goal of $3,000,000. With $2,140,834 pledged, as of March 13, member giving stands at 71 percent of the necessary total. Industry has pledged $4,122,483, or 82 percent, of its allotted $5,000,000 share. Thus members and industry together have raised $6,263,417, or 78 percent of their combined goal of $8,000,000.

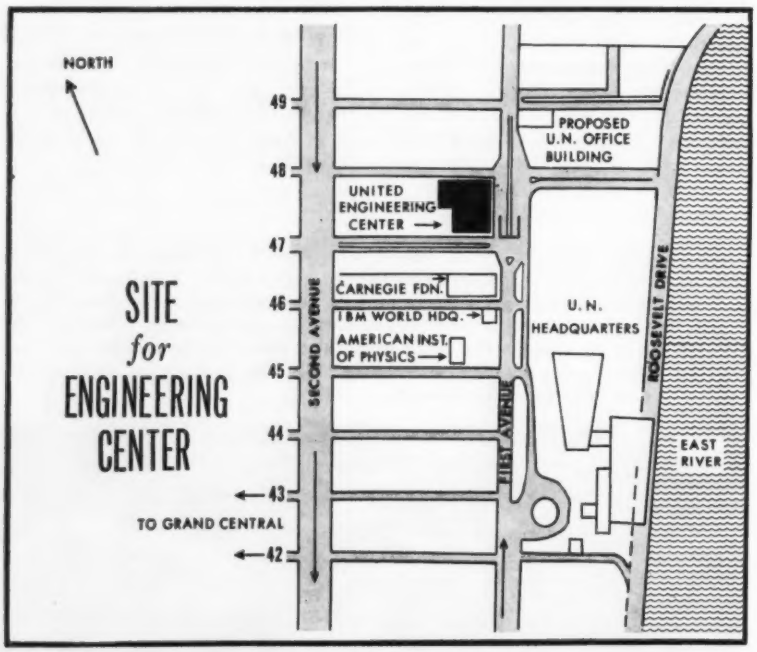
As a quick glance at the accompanying bar graph will show, the Chemical Engineers are within striking distance (93 percent) of their goal, and the Electrical Engineers are next with 79 percent of their quota pledged. ASCE has gone over the half-way mark, with 53 percent of its $800,000 share raised. However, though the Society is over half way to its goal, only a relatively few (6,282) of the Society's 42,000 members have contributed.

The campaign is being taken to every member through the ASCE Local Sections. Cited for honors are the eleven Sections that have brought their individual fund-raising campaigns triumphantly across the finish line. In the order of meeting their suggested quotas, they are Kentucky, Lehigh Valley, Nashville, Cincinnati, Columbia, Philadelphia, Hawaii, Rochester, Ithaca, Southern Idaho, and Indiana. District 4, comprising the Lehigh Valley area of Pennsylvania, went over the top last month—the first District to achieve this distinction.

Though no direct appeal has been made to the ASCE Student Chapters, a number of them have demonstrated their strong feeling for the Society and their awareness of the importance of the Center to the profession by making contributiosn on their own. In addition to the Chapters listed in the March issue, three others—the University of Oklahoma, the University of Illinois, and the Navy Pier Branch of the University of Illinois—have also sent contributions.

## Contractor for UEC Selected

As announced in a last-minute flash in the March issue, the Turner Construction Company, of New York City, has been named general contractor for the construction of the Center.




**When the United Engineering Center is completed, it will be a dominant structure in New York's fast-growing international area—one of the nation's most important and forward-looking centers.**

The metal, glass, and limestone structure will occupy a 37,000-sq ft site on the west side of United Nations Plaza between 47th and 48th Streets in New York. It will provide about 260,000 sq ft of floor space and will house a number of engineering groups in addition to the five Founder Societies. The Engineering Societies Library, the nation's most comprehensive repository of vital technical information, will also be located in the Center, as will five joint groups dealing with engineering research and improved educational standards. Space has also been set aside in the building to dramatize the creative role of engineers in advancing living standards the world over.

Greater economy has been effected by a decision to build an eighteen-story building (two ground floors, plus a sixteen-story tower) instead of the twenty-story structure originally planned. It is expected that ten of the tower floors will accommodate the five Founder Societies. Two of the remaining floors will probably be left unfinished until there is need for them.

## A Message from Chairman Kelly

In a message to members of the Societies cooperating in the UEC venture, Mervin J. Kelly, general chairman of the Industrial Building Fund Committee, sees the Center as essential to the Societies if they "are to meet their obligations of today and the challenges of tomorrow." He says the threat posed by Russia can only be countered by developing our nation's scientific and technologic capacities to the highest possible level. He emphasizes that, "The Societies make large contributions to the nation's technologic strength through the many services they render to engineers. They provide a professional framework for engineers. They provide publications, meetings, and forums for presenting information on technologic progress. They aid in the development of young engineers through establishing standards for engineering education, through student branch activities, and through the impact of their publications on engineering curricula."

Mr. Kelly goes on to say that the present Engineering Societies Building, "now more than fifty years old, is wholly inadequate; it is limiting the effectiveness of the Societies. The new Center is essential. Its location across from the United Nations is an ideal setting, typifying the Societies' national and international importance."

## ASCE Giving Passes $414,836 as of March 6

| Local Section | Quota | Amount Pledged | % Quota |
|---|---|---|---|
| **ZONE I (968)** | **$197,300** | **$119,881** | **61** |
| **District 1 (515)** | **133,300** | **85,158** | **64** |
| Brasil (2) | 2,100 | 70 | 3 |
| Metropolitan (466) | 119,200 | 81,118 | 68 |
| Panama (2) | 1,300 | 90 | 7 |
| Puerto Rico (13) | 3,100 | 2,330 | 75 |
| Rep. Colombia (6) | 2,400 | 230 | 10 |
| Venezuela (26) | 5,200 | 1,320 | 25 |
| **District 2 (211)** | **43,400** | **19,610** | **45** |
| Connecticut (66) | 11,000 | 6,913 | 63 |
| Maine (4) | 4,700 | 245 | 5 |
| Massachusetts (105) | 23,000 | 9,534 | 41 |
| New Hampshire (10) | 1,800 | 438 | 25 |
| Rhode Island (26) | 2,900 | 2,480 | 85 |
| **District 3 (242)** | **20,600** | **12,613** | **61** |
| Buffalo (48) | 4,400 | 2,285 | 54 |
| Ithaca (42) | 2,400 | 2,549 | 106 |
| Mohawk-Hudson (57) | 7,500 | 2,893 | 39 |
| Rochester (40) | 1,900 | 2,219 | 117 |
| Syracuse (55) | 4,400 | 2,667 | 60 |
| **ZONE II (1567)** | **169,700** | **82,151** | **48** |
| **District 4 (544)** | **34,000** | **36,936** | **109** |
| Delaware (88) | 4,100 | 3,474 | 85 |
| Lehigh Valley (89) | 4,200 | 5,517 | 131 |
| Philadelphia (211) | 20,000 | 22,510 | 113 |
| Central Pa. (156) | 5,700 | 5,435 | 95 |
| **District 5 (205)** | **27,000** | **6,232** | **23** |
| Nat'l Capital (205) | 27,000 | 6,232 | 23 |
| **District 6 (370)** | **49,000** | **15,512** | **32** |
| Maryland (145) | 15,000 | 5,511 | 37 |
| Pittsburgh (134) | 17,000 | 4,604 | 27 |
| Virginia (87) | 13,300 | 4,341 | 33 |
| West Virginia (4) | 3,700 | 1,056 | 29 |
| **District 10 (448)** | **59,700** | **20,971** | **35** |
| Alabama (53) | 8,900 | 2,244 | 25 |
| Florida (11) | 11,500 | 1,090 | 9 |
| Georgia (101) | 10,400 | 6,388 | 61 |
| Miami (8) | 5,200 | 390 | 8 |
| Nashville (56) | 2,700 | 2,740 | 101 |
| N. Carolina (33) | 6,300 | 2,991 | 47 |
| S. Carolina (80) | 5,500 | 2,140 | 39 |
| Tenn. Valley (86) | 9,200 | 2,988 | 32 |
| **ZONE III (1750)** | **202,200** | **105,638** | **57** |
| **District 7 (255)** | **39,900** | **11,734** | **29** |
| Duluth | 1,500 | | |
| Michigan (39) | 18,000 | 2,109 | 12 |
| Northwestern (41) | 8,000 | 1,840 | 23 |
| Wisconsin (173) | 10,700 | 7,745 | 72 |
| S. Dakota (2) | 1,700 | 40 | 2 |
| **District 8 (225)** | **37,100** | **23,299** | **63** |
| Cent. Ill. (51) | 6,500 | 3,105 | 46 |
| Illinois (174) | 29,000 | 20,194 | 70 |
| Tri-City | 1,600 | | |
| **District 9 (585)** | **45,700** | **33,980** | **74** |
| Akron (29) | 3,100 | 1,240 | 40 |
| Central Ohio (60) | 5,100 | 2,072 | 41 |
| Cincinnati (123) | 4,700 | 6,552 | 139 |
| Cleveland (29) | 9,300 | 3,800 | 41 |
| Dayton (23) | 3,300 | 1,988 | 60 |
| Indiana (217) | 11,000 | 11,495 | 105 |
| Kentucky (103) | 6,100 | 6,583 | 108 |
| Toledo (1) | 3,100 | 250 | 8 |
| **District 14 (179)** | **31,500** | **13,287** | **42** |
| Mid-Missouri (19) | 3,500 | 740 | 21 |
| Mid-South (63) | 11,000 | 5,534 | 50 |
| Oklahoma (36) | 6,900 | 2,279 | 33 |
| St. Louis (61) | 10,100 | 4,734 | 47 |
| **District 16 (506)** | **48,000** | **20,838** | **43** |
| Colorado (38) | 13,900 | 2,388 | 17 |
| Iowa (97) | 5,900 | 4,087 | 69 |
| Kansas City (215) | 12,000 | 9,327 | 78 |
| Kansas (88) | 7,600 | 3,057 | 40 |
| Nebraska (66) | 6,300 | 1,949 | 31 |
| Wyoming (2) | 2,300 | 30 | 1 |
| **ZONE IV (1715)** | **230,800** | **107,166** | **46** |
| **District 11 (871)** | **132,600** | **56,036** | **42** |
| Arizona (28) | 5,000 | 1,725 | 35 |
| Hawaii (211) | 6,300 | 7,282 | 116 |
| Intermountain (28) | 4,700 | 892 | 19 |
| Los Angeles (297) | 50,200 | 16,314 | 32 |
| Sacramento (20) | 16,300 | 1,124 | 7 |
| San Diego (58) | 6,000 | 2,186 | 36 |
| San Francisco (229) | 44,100 | 26,513 | 60 |
| **District 12 (399)** | **40,400** | **19,985** | **49** |
| Alaska (13) | 2,200 | 640 | 29 |
| Columbia (73) | 2,200 | 2,773 | 126 |
| Montana (14) | 3,300 | 935 | 28 |
| Oregon (65) | 10,900 | 2,906 | 27 |
| Seattle (85) | 12,200 | 5,237 | 43 |
| S. Idaho (30) | 2,300 | 2,545 | 111 |
| Spokane (44) | 3,100 | 1,658 | 53 |
| Tacoma (75) | 4,200 | 3,291 | 78 |
| **District 13 (445)** | **57,800** | **28,645** | **50** |
| Louisiana (50) | 13,000 | 2,682 | 21 |
| Mexico | 1,400 | | |
| New Mexico (13) | 4,000 | 705 | 18 |
| Texas (382) | 39,400 | 25,258 | 64 |
| Totals (6,000) | $800,000 | $414,836 | 52 |

*Note:* Number of pledges shown in parentheses.

## Table 1. Quotas and Pledges to UEC as of March 13

| Society | Goals in Dollars | No. of Subscribers | Amount Pledged | % of Goal | $ per Subscriber |
|---|---|---|---|---|---|
| ASCE | 800,000 | 6,282 | 420,999 | 53 | 67 |
| AIME | 500,000 | 3,002 | 237,645 | 48 | 79 |
| ASME | 800,000 | 9,116 | 455,173 | 57 | 50 |
| AIEE | 900,000 | 18,606 | 710,438 | 79 | 38 |
| AIChE | 300,000 | 6,529 | 278,171 | 93 | 42 |
| Others | ..... | 419 | 38,406 | .. | 92 |
| Total | * 3,000,000 | 43,954 | $2,140,834 | 71 | 49 |
| Industry | 5,000,000 | 377 | 4,122,483 | 82 | 1090 |
| Grand Total | 8,000,000 | 44,331 | 6,263,317 | 78 | |

* While the overall goal of member giving is shown as $3,000,000, the quotas accepted by the Societies total $3,300,000.

## UEC HONOR ROLL

All honor to the ASCE Local Sections that have gone over the top in meeting their quotas for the United Engineering Center and are pressing on toward goals of their own. The Sections are listed here in the order of reaching their goals. The figures indicate percentages of quota currently attained.

**Kentucky (108)**
**Lehigh Valley (131)**
**Nashville (101)**
**Cincinnati (139)**
**Columbia (126)**
**Philadelphia (113)**
**Hawaii (116)**
**Rochester (117)**
**Ithaca (106)**
**Southern Idaho (111)**
**Indiana (105)**

District 4 is first and alone among the Districts—it has currently chalked up 109 percent of its quota.

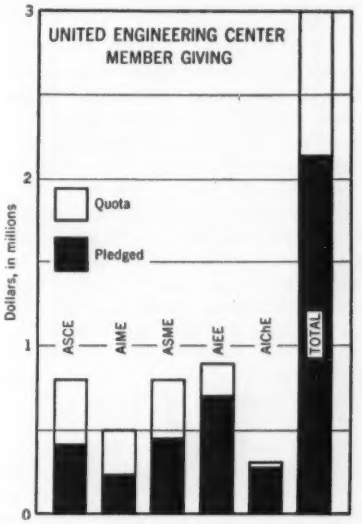



**Fig. 1. Member giving for United Engineering Center as of March 13.**

## Irrigation and Drainage Conference Set for May

A variety of irrigation, drainage, and flood control problems will be discussed at the Triennial Technical Conference of the U.S. National Committee of the International Commission on Irrigation and Drainage, set for Reno, Nev., May 11 and 12. Papers scheduled for presentation have been arranged to relate to the topics planned for discussion at the Fourth International Congress, which will be held in Spain next year. These topics are:

1. Reclamation of Waterlogged and Marshy Lands.

2. Sprinkler Irrigation and Comparison with Other Methods of Irrigation.

3. Tolerance of Plants to Minerals in Solution in Irrigation Water and Soils.

4. Use of Longitudinal Levees as Flood Protection Measures.

In 1957 the Committee was one of the sponsoring groups for the Third International Congress on Irrigation and Drainage, which was held in San Francisco. The United States is one of 42 nations affiliated with the International Commission on Irrigation and Drainage.

# Engineers and Unions—California Report

*Recent experiences of California engineers (employers and employees) with unions were reported at the Los Angeles Convention in a stimulating session of the Department of Conditions of Practice. The reports of three consultants in the San Francisco Bay area—presented under sponsorship of the ASCE Committee on Employment Conditions—are printed here to give members an idea of the unionization situation in an important metropolitan area.*

## Part I

**WILLIAM W. MOORE, M.ASCE,** Partner, Dames & Moore, San Francisco, Calif.

The question of unionization of engineers is one that has been raised many times—and one that probably will come up more often and more forcefully in the future.

The purpose of this discussion is to describe a few experiences and make a few observations for the benefit of those who may not have had first-hand experience. It is hoped that it will help you to be a little better informed and, consequently, better able to make your own decisions and choose actions in keeping with your beliefs and principles.

It must be emphasized that there is no simple or conclusive answer to the question of unionization for engineers. Engineers (both employees and employers) have the same economic problems and desires as other members of the business community. It may be a healthy thing that engineers are made to feel the pressure of organizational activity. Such pressure may be a factor in maintaining fair and proper standards of pay and working conditions. If these standards are not met, the resulting attitudes will provide encouragement to formal unionization activities. However, even if fees, rates, and working conditions are adequate, there will still be pressures for unionization. These pressures come from at least three sources: (1) from engineers who want more than they receive, (2) from union organizations that want larger membership and more dues, and (3) from union organizations which want wider and stronger control over an industry—in our case, the construction industry.

The developments within my firm over the past twenty years will serve to illustrate a pattern of policies.

A little over fifteen years ago some contacts were made between a few of our employees in Los Angeles and representatives of both the C.I.O. and A. F. of L. Some employees believed that joining one of these groups would improve their economic position, and they favored such action. However, after discussing and debating the matter for some time in their own groups, a majority decided against such an affiliation, and the matter was dismissed, at least temporarily.

Early in 1944 an approach was made to our San Francisco office by representatives of the A. F. of L. union. They demanded that we sign a contract recognizing the union. We took the view that the employees could join if they wished, but we would not sign such a contract. No further action occurred at that time.

Again in 1956 our firm was approached, this time by a branch of the Operating Engineers of the A. F. of L. Representatives of the union called at our office and, after some preliminaries, demanded that I sign a contract requiring our employees to join up. I said that that would be illegal, but that they could talk to our employees outside working hours. If the employees wished to join that would be their own business. This position was unacceptable to the union representatives, who said they would proceed with picketing and other secondary boycott measures to force us to accept their contract.

This negotiation was followed by charges of unfair practices in the district Labor Councils of two counties in the San Francisco Bay area. The union requested strike sanction in support of the proposed picketing. On several occasions, our clients received threats that their construction work would be tied up by strikes unless they replaced us as their engineers, or persuaded us to sign up. On one occasion, when a strike had been promised, we had our attorney and photographers on hand to gather direct evidence of secondary boycott action. However, no pickets appeared, and the work went on. This type of coercion by threat is very effective with some clients. In some instances the union is able to achieve at least part of its purpose by inducing a firm's client to retain another engineering firm—and if possible, one that will formally recognize the union.

We have experienced no further contacts or threats for the past couple of years, but we always expect that there will be more of them. In summary, I believe the engineering profession must arrange its own affairs and conditions of practice so that both employees and employers are satisfactorily compensated—both in money and professional recognition. If the management of an engineering firm stops considering engineers as individuals and starts treating them as large groups, the stage is set for unionization.

Developments in our economy are shifting large numbers of workers from both skilled and unskilled trades to highly trained technical and professional duties. The major labor organizations are well aware that their future growth and influence must come from these technical and professional (or white-collar) groups. Extensive and forceful plans for organizing these groups are being developed. For more details on these plans, I would like to refer to the November 1958 issue of *Nation's Business*.

It is interesting to visualize the situation that the design engineer, general contractor, and project owner will be in when the operators of tractors, bulldozers, and other equipment and the field engineers and inspectors are all under the control of one union leader. Unless the present labor laws are greatly revised, little protection is offered to any group or employee who prefers to remain unorganized.

With this situation confronting us, all engineers should consider, very carefully, the nature of any organization with which they may become affiliated. Factors to be weighed should include the degree of member control in the organization, and its policies concerning ethical and professional responsibility and attitudes.

## Part II

**ARNOLD OLITT** Partner, Woodward, Clyde, Sherard & Associates, Oakland, Calif.

Our firm's management was contacted in January 1955 by the Operating Engineers' Local No. 3 (A. F. of L.) in a manner similar to that described by Mr. Moore. The union requested that we enter into a contract, stipulating our employees must join the union within 30 days of being hired and that we would have to fire those who did not join. We refused to sign a contract without an election to determine whether our employees desired to join a union, indicating to the union representatives that if our employees elected to join their union and requested a contract we would then negotiate with the representatives of the union of their choice.

Many employees of our company as well as those of other firms in the San Francisco Bay area were then approached by the union. The result of this action caused some of our employees to seek legal advice. We understand that they

were told they could either decide to join the Operating Engineers Local No. 3, join some other union, or not join any group at all.

An organizational meeting of the employees of five firms was held, and the employees of four of these firms then decided to form a local chapter of the Engineers and Scientists of California, which is affiliated with the Engineers and Scientists of America. The Engineers and Scientists of California had been previously certified by the National Labor Relations Board as an employees' bargaining agent. The ESC, at that time, were representing employees of the Pacific Gas and Electric Company and of the member firms of the Western Association of Engineers & Land Surveyors (Stockton to Santa Rosa).

The ESC requested that each individual firm negotiate a contract with them as representatives of the employees. This the firms refused to do, stating—as they did with the Operating Engineers—that if the employees decided in a properly conducted election that they wished to be represented by a union we would negotiate with such a union, but that no contract would be signed with any union until we knew the desires of the employees. We also informed the ESC that we wished to form an employers' group.

The ESC petitioned the NLRB for a hearing, first, and then an election of the employees of the four firms if the employees wished to be represented by the ESC.

In order to be legally certified by the NLRB, a bargaining representative of the employers had to be set up which would come under the Taft-Hartley Act. We submitted the necessary material indicating that we qualified.

Once the employer group was certified by the NLRB, and the petition by the ESC approved, two elections were held to determine (1) if the professionals wished to be included in the same bargaining group with the technical employees, and (2) whether the group including professionals (if they wished to join the group) desired to be represented by the ESC. Clerical help and supervisory employees were not included in the bargaining unit. We had previously agreed with the union as to who was a technical or professional employee and therefore entitled to vote in the election, and who was in the clerical or supervisory class and therefore not included in the bargaining unit. In both instances, the vote was in the affirmative. After the vote, a contract was negotiated between the employers' and the employees' representatives.

The first contract was entered into in November 1956. The ESC presented an initial contract, which on most points was satisfactory. Certain counter demands were made by the employer group, and resulting compromises were agreed to by the parties concerned. Most of the requests for subsequent contract changes have dealt with increases in salary. The items affected are: (1) number of paid holidays, (2) increase in vacation period, (3) larger mileage allowance, and (4) actual increase in monthly salary.

The effect of unionization on the employees has been to better their working conditions, raise their wage scale, protect them from interference by other unions, and make them better understand the problems of management in its dealings with employees. There are certain disadvantages, too. Most important is the fact that the recommended minimum wage is usually considered the maximum. In addition, management is not as lenient with respect to sick leave, vacations, and retention of employees during slack periods as when there is no union.

There are also certain benefits to management in its dealings with unionized employees. First, various firms are forced to band together and, therefore, get to know the principals of other firms in the same business and become acquainted with their mode of operation. Second, firms, like employees, are protected from other union interference. Naturally, there are some disadvantages to employers, also. There is, for instance, a great deal of additional paper work involved, such as check-off sheets for union employees, authorizing payroll deductions for union dues, notification to the union of employment of eligible employees, termination notifiction, etc. Of course there is also the threat of a strike during contract negotiations.

Since our group has had only 2½ years of experience, it is difficult to state positively how unionization has worked out. In general, however, our dealings with the union have been amicable.

## Part III

**JACK Y. LONG, M. ASCE,** Partner, J. Y. Long Company, Engineers, Oakland, Calif.

This discussion will report on unions as they relate to the civil engineer and land surveyor in private practice in California.

Prior to World War II, an American Federation of Labor trade union contacted firms in the San Francisco area with respect to unionization of personnel. In that period an employers' organization, called the Bay Counties Civil Engineers and Land Surveyors Association, Inc., was formed. During the war the union, known as Technical Engineers, Architects and Draftsman's Union, obtained contracts with war-time agencies in the shipyards and defense plants. After the war many of these men were employed in private practice offices. The organizational activities of this union accelerated the formation of employer groups so that the Bay Counties Civil Engineers and Land Surveyors Association became an association of three chapters.

During 1946 and 1947 some association members were affected by strike action, but by the cooperation of other firms and effective operation of the association remained in business. Only a few firms, not members of the association, accepted union contracts. The union was not successful in maintaining adequate membership, and in 1948 was succeeded by the Technical Division of the Operating Engineers.

Early in 1949, strong secondary pressures were applied to clients of the Peninsula Chapter members, and at a special meeting of the association in May 1949 the chapter announced that it could no longer resist the economic pressure of losing clients and was prepared to resign from the association. After much discussion it was agreed that we could not reasonably continue to combat the union on a partial basis, and agreed to ratify a contract, covering field employees only, with the Technical Division of the Operating Engineers, Local No. 3. Committees from the union and the association met to draft a contract, and the first agreement was completed in June 1949.

In the Los Angeles area, a similar condition existed, and an employer organization known as the Civil Engineers and Land Surveyors was formed. The first contract, covering field employees, was signed in August 1950 with the Technical Division of the Operating Engineers, Local 12. This was done after several firms had been struck and were under pressure from their subdivision clients to settle their differences with the union.

Since that time contracts with employer organizations have been negotiated by the Operating Engineers in San Diego, Riverside, and Santa Clara County. The Engineers and Scientists of California have negotiated a contract with the Western Association of Engineers and Land Surveyors in the Sacramento and Santa Rosa areas. The American Federation of Technical Engineers have a negotiated contract with the San Joaquin Valley Association in the Fresno area. The Tri-County Association of Civil Engineering Employees has negotiated a contract with the employers in the Santa Barbara area.

In general, employer-union relationships have been good. Most contracts

have been reopened on a yearly basis and have provided increased benefits to the employee in the form of salary increases and health, welfare, and pension benefits. In many cases, employer engineers have been pleased with the results. Often, in the past, many firms did not provide adequate employee salaries and benefits. This was primarily due to inadequate compensation, and the fact that these employers seemed unable to get together to improve salaries and fees. The unions forced the association of employer engineers. These associations now have many fields of endeavor providing broad benefits to these employer firms. There is now a California Council of Civil Engineers and Land Surveyors composed of twelve of these associations.

The problems of a trade union under the conditions of professional and technical employment have not been completely solved. While apprentice and trainee programs have been discussed by the unions, little or nothing has been done in this field in the San Francisco Bay area. In recent months the Los Angeles Association has had a committee working with Local 12 of the Operating Engineers on an apprentice program, to be sponsored jointly by the union and the employers. A system of rating members of the union is also being studied. This is the first real effort in this direction, and it will be watched with lots of interest.

The bulk of the men employed by our civil engineer and land surveyor groups under these contracts work as chiefs of party, instrumentmen, and chainmen in field survey parties. We find that there are comparatively few young men with college training going into the field and that our transitmen are the older men with a field experience background. Chainmen provided are younger men with little or no experience and seldom with professional training.

As professionals, we must keep pace with the social and economic changes of the times. It is true that some phases of our work are not completely professional; however, it is very important that our younger men gain the knowledge and experience of performing this work. If we place these jobs in technical classifications, we lose the opportunity of good internship. This is a real problem and one difficult of solution.

In his training, a young engineer does a variety of work, ranging from routine duties to various stages of professional qualification. This is as true of the man in a survey party in the field as it is of a draftsman in the office. Obviously, many phases of experience are desirable to develop a broad background of experience and a good civil engineer.

Classifications necessary under a trade union structure tend to specialize work procedures. It is my considered opinion that specialization, even at the full professional level, lowers the engineer to technician status, with his work too often directed by others, including nonprofessionals.

If we recognize that unions have a place in our field of endeavor, how can we define where technical classifications should stop and professional positions begin?

I have no quarrel with unions. However, at this time, after approximately ten years of experience with unions in our profession, I am not yet convinced that they have attained the objective they have offered to their members and to employers in the field of engineering. In most cases that I am familiar with, the employer groups and the unions, while not always agreeing on many points, have had friendly relationships. It is difficult for unions to meet the problems of professional activity in engineering as it also is in law, medicine and the sciences.

## EJC to Aid in UNESCO Conference on Latin America

Through its Committee on International Relations Engineers Joint Council will aid in preparing the program for the Seventh Biennial Conference of the U.S. National Committee for UNESCO (United Nations, Education, Scientific, and Cultural Organization), set for September 29-October 2, 1959. Latin America will be the theme of the conference, and the program is being organized around the three general areas of Education, Science, and Culture.

Dean Alan A. Manchester of Duke University is developing the program in the area of science and has requested the assistance of the Committee on International Relations. The committee will also be instrumental in developing the engineering part of the program. Overall program planning will be the responsibility of the Committee on Planning and Arrangements of the U.S. National Committee for UNESCO, headed by ASCE Past-President Carlton S. Proctor.

## General Society Business Meeting

A general business meeting of the Society has been called for 9 a.m., Wednesday, May 6, in the Cleveland Room of the Hotel Sheraton-Cleveland, during the Cleveland Convention. In addition to providing for the transaction of any general ASCE business, the meeting will feature the President's annual address.

## Report of Third EUSEC Conference Available

Availability of the Proceedings of the Third Conference on Engineering Education and Training, held in Paris in September 1957 under sponsorship of the Europe-United States Engineering Conference (EUSEC), is announced. EUSEC is made up of the presidents and secretaries of nineteen engineering societies in thirteen nations. Since 1951 committees of experts from these societies have conducted three international conferences aimed at throwing light on the engineering education and training procedures practiced in the countries represented.

The Proceedings of the Third Conference includes preliminary reports for each country, covering (1) diagrams illustrating the engineering education system; (2) a description of general education before admission to engineering schools; (3) engineering education at university level; (4) education at postgraduate level; and (5) criteria for professional recognition. The reports are said to constitute the most comprehensive analysis of engineering education in the various countries yet published. Because the reports are necessarily abbreviated, three of the countries—Belgium, the United Kingdom, and the United States—have published appendixes containing their complete reports as submitted to the Conference.

In the United States, both the Conference Proceedings and the U.S. Appendix may be ordered from Engineers Council for Professional Development, Room 1401, 29 West 39th Street, New York 18, N.Y. They are $3.50 each, but may be bought together at a package price of $6.00. The British Appendix, priced at 15s to members and 20s to non-members of EUSEC societies, should be ordered from the Institution of Mechanical Engineers, 1 Birdcage Walk, Westminster, London SW1, England. The Belgian Appendix, priced at 30 Bf, is available from the Societe Royale Belge des Ingenieurs et des Industriels, 3 Rue Ravenstein, Brussels, Belgium.

## Questionnaire Aids "Civil Engineering"

Each month CIVIL ENGINEERING sends questionnaires to 200 of its readers, asking their ratings of the month's articles and departments, and inviting them to give their ideas for improving the magazine. Many readers use the opportunity to "blow off steam" about a variety of civil engineering problems. Others simply write "doing a fine job—keep it up."

Most replies, however, have been straightforward requests for articles on specific subjects, ranging from "more on foreign construction jobs," to "not so much on big jobs—more on small, practical everyday problems."

Well, it's not possible to satisfy all the readers all the time, but in choosing articles for publication, CIVIL ENGINEERING has managed to cover a wide variety of the subjects most asked for in the survey.

The 695 questionnaires that were returned last year showed that the average reader spends 3 hours and 39 minutes a month with CIVIL ENGINEERING. In the department rating section, the number one favorite was Feature Articles, with "News Briefs" and "Do You Know That" running a close second and third.

Below, is a list of blue-ribbon articles—those with the top rating for their month.

| Month | Title | Author |
|---|---|---|
| Jan.: | Tied-Cantilever Bridge—Pioneer Structure in U.S. | Homer M. Hadley |
| Feb.: | Growing Pains in Prestressed Concrete Buildings | Allen H. Brownfield |
| March: | The Engineer Through the Ages—Roman Empire, Part 5 | J. K. Finch |
| April: | Cable-Supported Roof Cuts Stadium Costs | M. Shupack |
| May: | Computers Spark a Revolution in Design Practice | N. M. Newmark |
| June: | *The Engineer-Contractor Relationship | Herbert R. Falk |
| | *Bonding Thin Concrete to Old Pavements | W. G. Westall |
| July: | Four-Lane Rectangular Tunnel Under Fraser River | Per Hall |
| | Placed by Trench Method | D. A. Young |
| Aug.: | How Can Engineering Teaching Be Improved | Charles E. Carver, Jr. |
| Sept.: | Pipelining in Marsh, Swamp and Open Water | William T. Ivey |
| Oct.: | American Engineer Views Concrete in Soviet Union | David P. Billington |
| Nov.: | Deep Foundations in Soft Chicago Clay | Edward E. White |
| Dec.: | Holland Pushes Back the Sea | Harry H. Power |

*Tied for first place in June

## Board Rules on Ethics Violation

Charges of unethical practice were heard by the Board of Direction at the Los Angeles Convention. The case involved an ASCE member whose partner, a non-member, had participated in activity that was contrary to the Code of Ethics. Acting independently, the partner had submitted price quotations in answer to invitations for proposals on engineering services. The partnership agreement permitted such independent activity. It also provided that in these instances the individual would receive the fees and assume all responsibility.

Specific charges cited violations of Article 10 of the ASCE Code of Ethics and Section 28 of the ECPD Canons of Ethics:

Article 10—ASCE Code of Ethics—states that, "It shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member of the American Society of Civil Engineers . . . to act in any manner or engage in any practice which will tend to bring discredit on the honor or dignity of the engineering profession."

Section 28—ECPD Canons of Ethics—states that, "He (the engineer) will not become associated in responsibility for work with engineers who do not conform to ethical practices."

The Board, acting through the Committee on Professional Conduct, and in accordance with Article II, Section 2 of the By-laws, found the defendant guilty of the charges. As a result of this ruling, the Board sent the defendant a letter of admonition against future violations of the Code of Ethics.

## Alabama Section Urges State Docks Inquiry

The Alabama Section is being commended for taking action in the mutual interest of the public and the civil engineering profession in a situation involving the Alabama State Docks. In recent months affairs at the State Docks have been widely discussed and criticized in the press. Both articles and editorials have suggested that its affairs have been mismanaged. Because engineers and engineering firms have figured prominently in the complaints, engineers all over the state have expressed a desire to have the situation investigated.

In response to a specific request that the Alabama Section take action in the matter, its Board of Directors on January 30 unanimously passed a resolution, recommending inquiry into the matter of engineering contracts at the State Docks and commending the recent action of Governor Patterson in launching such an investigation.

Noting that since "the engineer's position is one of trust, he must accept all the responsibilities that go with this trust," the Section went on record as recommending "that appropriate inquiry into the matter of engineering contracts at the Alabama State Docks be made." The resolution states that the "Board does not assume or conclude that there has been perpetrated any act of wrong doing of any nature in any of said contracts." It also asserts that the Board itself "could not and should not in this instance act in an investigative capacity."

Copies of the resolution have been sent to the Governor of Alabama, the Attorney General of the state, and the Director of the State Docks.

### ASCE ENGINEERING SALARY INDEX

**Consulting Firms**

| CITY | CURRENT | LAST QUARTER |
|---|---|---|
| Atlanta | 1.22 | 1.11 |
| Baltimore | 1.11 | 1.11 |
| Boston | 1.15 | 1.13 |
| Chicago | 1.30 | 1.26 |
| Denver | 1.20 | 1.19 |
| Houston | 1.12 | 1.08 |
| Kansas City | 1.14 | 1.14 |
| Los Angeles | 1.21 | 1.16 |
| New Orleans | 1.21 | 1.22 |
| New York | 1.21 | 1.17 |
| Pittsburgh | 1.05 | 0.93 |
| Portland (Ore.) | 1.11 | 1.15 |
| San Francisco | 1.19 | 1.17 |
| Seattle | 1.06 | 1.07 |

**Highway Departments**

| REGION | CURRENT | LAST QUARTER |
|---|---|---|
| I, New England | 0.89 | 0.85 |
| II, Mid. Atlantic | 1.17 | 1.17 |
| III, Mid. West | 1.25 | 1.15 |
| IV, South | 1.10 | 1.07 |
| V, West | 1.02 | 0.97 |
| VI, Far West | 1.15 | 1.15 |

Sole purpose of this Index is to show salary trends. It is not a recommended salary scale. Nor is it intended as a precise measure of salary changes. The Index is computed by dividing the current salary total for ASCE Grades I, II and III by an arbitrary base. The base used is $15,930. This is the total of salaries paid in 1956 for the equivalent Federal Grades GS5, GS7 and GS9. Only the annual base entrance salaries are used in these calculations. Index figures are adjusted semi-annually and published monthly in CIVIL ENGINEERING. Latest survey was January 31, 1959.

# Division Doings

## Hydraulics Conference

The Hydraulics Division's prime concern at the moment is its Eighth Annual Hydraulics Conference, which will be held in Fort Collins, Colo., July 1-3. Hosts this year are the Colorado and Wyoming Sections and Colorado State University. In addition to three days of technical sessions, there will be an all-day field trip through the beautiful Colorado Rockies. There will also be plenty of opportunities for fun and good fellowship.

Aylesworth Hall, a comfortable new dormitory on the university campus, will be the housing center for the conference. It is close to the new Engineering Auditorium where all conference sessions will be held. Rooms will be available at the following special rates: $2.50 single, $2.00 (per person) double. Except for the special meal events, meals will be priced as follows: breakfast, 75 cents; luncheon, $1.00; and dinner, $1.25. Children's rates are 65 cents, 95 cents, and $1.10 for the three meals.

Several hotels and motels are available, in addition to these facilities. Persons preferring off-campus accommodations should write to the Housing Committee.

Special events will include a conducted tour of the Hydraulics Laboratory and other engineering facilities at Colorado State. A trip through the Bureau of Reclamation's Hydraulics Laboratory in Denver is also scheduled. The all-day guided tour, on June 30, will take members to the Big Thompson Irrigation and Power Project. This trip includes a drive across the Continental Divide over Trail Ridge Road (elevation 12,000 ft) in scenic Rocky Mountain National Park. The program will include papers on hydraulic structures, hydraulic models, instrumentation, and the use of computers in hydrology. Papers on sedimentation and flood control will round out three days of excellent technical sessions. An evening social hour with cocktails will follow the all-day field trip on June 30. The social agenda will also include a barbecue on Wednesday evening and a special banquet on Thursday evening.

Since accommodations for tourists in the mountain areas vary widely, information concerning the various facilities can be obtained through the Housing Committee. Specific reservations with regard to location and price can then be made through the Committee or directly with the resort desired. Most of the mountain facilities are between one and two hours' drive from Fort Collins.

## Engineering Seismology

The Structural Division is pushing two recent publications of special interest to its Task Committee on Seismological Forces. One of these is a *Bibliography of Engineering Seismology (second edition)*, by Edward P. Hollis, containing over 2,000 entries and cross references. It presents a thorough coverage of publications in English as well as a good representation of Japanese, Russian, and other foreign language material. Selling price of the 144-page cloth publication is $4.50. The other is a *Bibliography of Effects of Soil Conditions on Earthquake Damage*, by C. Martin Duke. This is very detailed, including over 275 specific entries —many of them heretofore little-known Japanese references. The 47-page publication is paper bound and sells for $1.00. If both are ordered, a special price of $5.00 for the two is available. They may be ordered from the Earthquake Engineering Research Institute, 465 California Street, San Francisco 4, Calif.

## Conference on Applied Mechanics

The 1959 West Coast Conference on Applied Mechanics will be held at Stanford University, September 9-11. This conference has been co-sponsored by the West Coast Committee of ASME and ASCE (through the Engineering Mechanics Division) since 1954, and has become a highly successful annual feature. The conference will promote the presentation of original papers in the field of applied mechanics, including dynamics, vibrations, elasticity, plasticity, properties of materials, and non-linear mechanics, and bring together persons with a mutual interest in these fields. Authors are invited to send manuscripts (in triplicate) directly to the Secretary of the ASCE West Coast Committee: Dr. James M. Gere, Department of Civil Engineering, Stanford University, Stanford, Calif. Manuscripts may also be sent to the Manager of Technical Publications, ASCE, in which case the author should state that he would like to have his paper presented at the West Coast Conference.

## Committee on Pipeline Locations

The Pipeline Division's Task Committee on Pipeline Location met in New Orleans in February to improve outlines and assign writing tasks. The Task Committee is to prepare material on pipeline location surveys and related functions for publication in the Journal of the Pipeline Division, with the potential further objective of preparing a Manual of Engineering Practice on the subject. E. O. Scott, of the Service Pipe Line Co., Tulsa, Okla., is chairman of the committee.

**Airport designers and operators, airline administrators, aircraft manufacturers, and government officials will participate in the Society's Second Jet-Age Conference, set for Houston, Tex., May 20-22 (see the program elsewhere in this issue). Sponsors are the Air Transport Division and the Houston Branch of the Texas Section, in cooperation with the Airport Operators' Council and the Air Transport Association. This airport terminal for one airline only—it is being built at New York's International Airport for American Airlines—is typical of the challenge offered in providing airport facilities for passengers and craft in the complex jet age.**

# THERE MUST BE AN EASIER WAY

EVEN THE MOST EXPENSIVE DRAWINGS HAVE A RELATIVELY SHORT LIFE
ANYONE WANT A SLICE OF PICKLE?
SHE DOESN'T FILE DRAWINGS, SHE SHREDS THEM
FOR GOSH SAKES, STOP! IT'S LUNCH HOUR!
HEY, JOE— WAKE UP! YOUR DRAWING'S ON FIRE!
IF WE HAD A BLUEPRINTER* MAKE AUTOPOSITIVE PAPER INTERMEDIATES, WE COULD KEEP OUR DRAWINGS OUT OF HARM'S WAY

*Much easier for you* when you have your local blueprinter—or your own print room—reproduce your drawings on new Kodagraph Autopositive Paper Translucent.

You get positive photographic intermediates directly—creases, pickle stains, bottle rings are dropped out . . . weak line detail gains surprising strength.

The main thing, of course, is that your "hundred dollar" originals are safe in the files, and you won't go blind or mad when you read "Autopositives" or prints made from them. And the cost of these intermediates is so trifling—their line detail so impervious to smudging and spilling—you won't worry a bit when lunch is served.

**Kodagraph**
**Reproduction Materials**

**EASTMAN KODAK COMPANY**
**Graphic Reproduction Division, Rochester 4, N. Y.**

**MAIL COUPON FOR FREE BOOKLET**

EASTMAN KODAK COMPANY
Graphic Reproduction Division, Rochester 4, N. Y.

Gentlemen: Send me a free copy of your booklet on Kodagraph Reproduction Materials. 93-4

Name_____
Position_____
Company_____
Street_____
City_____
Zone_____
State_____

Kodak

# The Younger Viewpoint

## The Voice of the Committee on Junior Member Publications

**Committee on Junior Member Publications**

**Milton Alpern, Chairman; 3536 Northview Ave., Wantagh, L. I., N. Y.**

| Zone I | Zone II | Zone III | Zone IV |
|---|---|---|---|
| Louis K. Walter, Jr.<br>320 Market Street<br>Kenilworth, N. J. | Albert C. Nelson<br>250 N.E. 51st Street<br>Miami, Fla. | Walter D. Linzing<br>4751 No. Paulina<br>Chicago 40, Ill. | Rodney P. Lundin<br>9744 Quakertown Ave.<br>Chatsworth, Calif. |


*This month the "younger viewpoint" is being expressed by our new Zone II representative, Al Nelson, of Miami, Fla., who replaces Ray Gordon, of Richmond, Va. Al's enthusiasm for the potential value of this column and of the committee is illustrated by his splendid handling of the column, which was prepared on less than two weeks' notice. Al was chosen from a number of other well qualified applicants from Zone II on the basis of his expressed understanding of the mission of "The Younger Viewpoint." Your active cooperation with Al is respectfully requested. His column follows.*

**What is the "younger viewpoint" worth?**

It was not too many years ago that the "younger viewpoint" was thought of as immature and impertinent. The elders of our society guided us in business and government, and because of this youth and its ideas were taken rather lightly. But lately, as the result of the rapidly changing technological field and the change in population trends, more responsibility is coming to rest on the junior members of our communities. For instance, in last November's balloting, one state elected a governor and a lieutenant-governor, both in their early thirties. In a recent *Fortune* magazine, it was noted that the president of General Dynamics is 46; the president of Philco, 44; the executive vice-president of the United States Trust Co., 43; the president of the Thomas J. Lipton Co., 45, and so on, these being picked at random. These statistics seem to indicate how very vital many businesses feel the "younger viewpoint" is. In government, too, the feeling seems to be that the younger viewpoint is necessary.

It is true, of course, that not all of us are cut out to be company presidents or geniuses in our particular fields of endeavor. But each and every one of us is capable of thinking rightly and of conceiving ideas.

Many of us agree that being younger members of the ASCE has its advantages. We must feel that way or we would not devote our precious time to Junior Member* activities. Nevertheless, some of our Junior Member groups are sluggish, and I am sure that many of us feel that these organizations are not functioning at full efficiency. That is where your viewpoint, "The Younger Viewpoint," comes in.

This page can become an idea center—a sort of question and suggestion box. A Junior Member* group that feels it is becoming stagnant might find that the inspiration afforded by your suggestion is just what it needs to get back on its feet. Perhaps you have an idea as to how money for the United Engineering Center can be raised painlessly. Maybe you feel that Junior Member* meetings should contain fewer facts and figures and more fellowship. If you have any idea or suggestion, trivial or important, it belongs on this page. So check the name of your committeeman (in the box on this page) and drop him a line. He'll be glad to hear from you.

**Some program suggestions follow.**

With spring here and outdoor activities beginning to take shape, it has been suggested that Junior Members* challenge the older Members in softball contests. This could develop into an interesting, and possibly comical, competition.

With bowling leagues catching on all over the country, have any Junior Member* groups thought of entering a league or of forming one themselves?

In February the Junior Members* of the Miami Section joined the older members and the Florida Engineering Society in celebrating Engineers' Week at their annual banquet and dance in the Everglades Hotel.

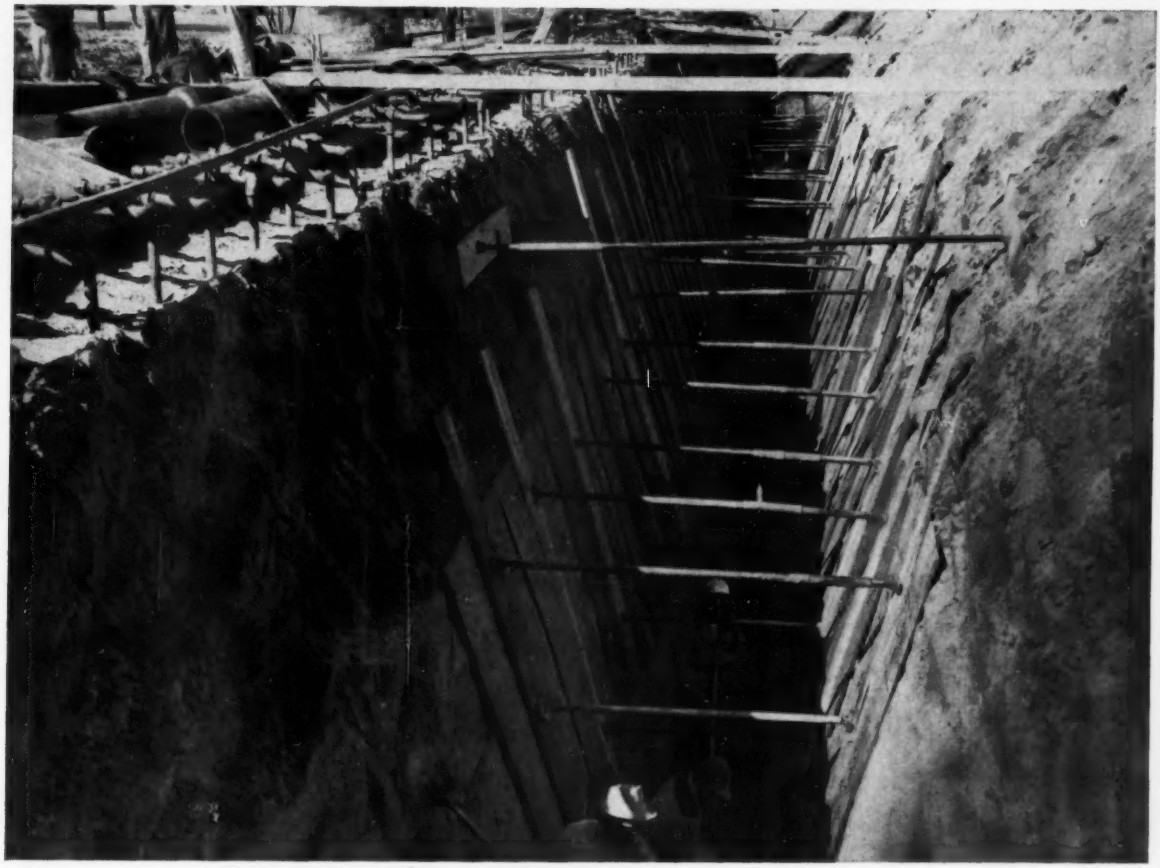
Teaching is one way the engineer can step from his shell into civic affairs. Two Junior Members* in the Miami area are now teaching vocational courses in Dade County's educational system—one the review course for the engineers' examination, the other a course in surveying. It is good to see an outside interest of this sort, and of course the profession will benefit from the professionalism imparted in these two courses.

*[This asterisk refers to the pleasant fact that very soon the term "Junior Member" will be history. By something like a ten-to-one majority, the civil engineers of ASCE have voted to change the name Junior Member to Associate Member. It is this committee's opinion that the vote is expressive of clear, young thinking in ASCE circles throughout the country. The Editor (Alpern).]*

## HOW TO HANDLE WET JOBS

*#45 of a series*

*Project:* Sanitary Sewers, El Paso, Texas
*Contractor:* T. N. O'Kelley, Utility Contractors, El Paso, Texas
*Owners & Engineers:* Public Service Board, El Paso, Texas



**Wellpoints on 1 side perform unusual feat in coarse sand . . .**

# Dry 18-ft Deep Trench at 3,700-ft Elevation

At the reduced atmospheric pressure of 2/3-mile above sea level, any pump works at a handicap. To compound this problem, the contractor desired to install his wellpoint system (Griffin system) at ground level. Previous wellpoint practice in the area was to place the system on a berm nearer subgrade because of pump lift limitations.

**Question:** in coarse water-bearing sand near the Rio Grande River, with discharge lines as long as 700 ft at times, could the necessary 18 ft lift be attained by a wellpoint system installed on only one side?

• Based on previous local experience it did not seem feasible, but events proved otherwise. Dry conditions were successfully maintained from the start, enabling T. N. O'Kelley to beat his 100-day time limit by 40 days.


**GRIFFIN WELLPOINT CORP.**

**SALES • RENTAL • CONTRACT**

GENERAL OFFICE: 881 East 141st St., New York 54, N. Y.

Branches: Jacksonville, Fla. • West Palm Beach, Fla. • New York, N. Y. • Hammond, Ind. • Houston, Tex.
In Canada: Construction Equipment Co., Ltd., Toronto • Montreal • Edmonton • Vancouver
In Venezuela: Drew Bear & Sons C.A., Caracas • Maracaibo

# NOTES FROM THE LOCAL SECTIONS

*(Copy for these columns must be received by the fifth of the month preceding date of publication)*

Elmer Maggi has been selected by the **Arizona Section's** board of directors as general chairman of the ASCE National Convention scheduled for the spring of 1961 in Phoenix. Mr. Maggi recently completed a busy four-year term on the Society's Committee on Local Sections.

The **Central Illinois Section** joined the Illinois Society of Professional Engineers in Decatur on February 26 for an "Engineers' Week Dinner." Those present heard Rear Admiral Rawson Bennett, II, Chief of Naval Research, Washington, D. C., discuss "Engineering Science and the Navy" Admiral Bennett's talk was very timely since the Office of Naval Research is engaged in the development of nuclear submarines, high-altitude manned balloon flights, the satellite tracking system, under-ice explorations in the Arctic, and other projects of great importance.

Guest speaker at the **Georgia Section's** February meeting was H. Page Nicholson. His subject was "Are Agricultural Insecticides Damaging Our Water Resources?" Dr. Nicholson is senior scientist with the U. S. Public Health Service and is in charge of insecticide pollution studies in the office of Water Supply and Water Pollution Control at Atlanta. The Section's **Central Savannah River Valley Branch** had John Vinciguerra, assistant manager for administration at the Savannah River Plant of the A.E.C., as guest speaker at a recent meeting. His talk, "Atoms in the Service of Humanity," dealt primarily with the U.S. Exhibit in the International Electronic and Nuclear Exposition and Congress held in Rome, in 1958, of which he was manager. The **Savannah Branch** held its regular meeting on February 4. J. Q. Williams of the Georgia Tech School of Physics presented an interesting and timely discussion of "Earth Satellites—Frontiers in Space."

An engrossing talk on flood control in the Greater Chicago area was given by Horace P. Ramey, chief engineer of the Metropolitan Sanitary District of Greater Chicago, at the **Illinois Section's** February 6 luncheon meeting. The plan presented by Mr. Ramey to develop rivers, streams, and canals required to handle any future heavy rain falls would require an expenditure of $100 million and a period of twelve years for execution.

**Engineers present at the annual joint meeting of the Kentucky Section and the Kentucky Society of Professional Engineers held in Lexington heard Dr. R. E. Fadum (second from left), head of the civil engineering department at North Carolina State University, speak on Engineering Education in the USSR. Others on the dais are Prof. D. K. Blythe (left), head of the civil engineering department at the University of Kentucky and secretary of the Kentucky Section; D. H. Sawyer (second from right), president; and R. D. Hughes (right) corresponding secretary of the Section.**

**Fred Paul Funda receives Certificate of Life Membership in ASCE from his longtime friend and fellow life member, Roy Worden. The presentation was made at a meeting of the Little Rock Branch of the Mid-South Section. Mr. Funda was an engineer with the Rock Island Railroad for most of his career. He retired in 1955.**

The **Lehigh Valley Section** met February 16 at Lehigh University to hear William S. Gardner, of Greer Engineering Associates, Montclair, N. J. talk on covered methods of design and construction used to cope with the unusual foundation conditions found in the Jersey Meadows, the Arctic, and Mexico City. Slides showing various soil sampling and drilling methods used to determine soil conditions at job sites supplemented the talk.

Robert B Diemer, general manager and chief engineer of the Metropolitan Water District of Southern California, and Richard B. Ward, district engineer in charge of construction for the enlargement of Lake Mathews, were presented Life Memberships in ASCE at a recent meeting of the **Los Angeles Section.**

A panel of manufacturers, operators, and consulting engineers discussed the important new development of aerobic digestion at the February meeting of the **Metropolitan Section's Sanitary Engineering Division**—a joint session with the Metropolitan Section of the New York State Sewage and Industrial Wastes Association. The panel consisted of Frank Burde, Dravo Corporation; Nissen Cahan, Infilco; Herman Zablotsky, Bergen County Sewer Authority; and Roy Weston, consulting engineer.

The **Nashville Section's** February meeting, climaxing Engineers' Week, was held in conjunction with the other engineering societies in the area. Guest speaker, John J. Amato, of the Sears Research and Testing Laboratory, explained some of the functions and operations of the laboratory. Interesting statistics in consumer goods consumption were given, indicating trends since World War II.

The **Sanitary and Hydraulics Engineering Division** of the **Philadelphia Section**

## Yours for the asking!

The facts in this book tell you how to get the most for your investment in a steel framed building. It's the story—told in pictures and text—of the proven Macomber "V" Section from steel coils to finished buildings. We will be pleased to mail you a copy.

M

**MACOMBER**

**CANTON 1, OHIO**

New officers of Mid-South Section's Jackson Branch are installed. Shown, in usual order, are James D. Shell, secretary-treasurer; Edwin E. Ware, Eugene T. Thomas, Herbert H. Lester, and William H. Robinson, directors; James M. Polatty, president; James E. Foster, past-president; and Robert H. Young, vice president.

Otis Gouty (center), assistant to the Executive Secretary of ASCE, is featured speaker at joint meeting of Kansas Section and Kansas State College Student Chapter. Mr. Gouty spoke on the place of ASCE and other professional groups in the all-important transition phase from student to engineer. With him are Chapter President Charles D. May (left) and Dale C. Spencer, vice president of the Section. The Chapter is justly proud of the fact that for the past four years every one of its graduating members has gone into the Society.

began its second year of activity with a series of interesting programs. The last three meetings consisted of a talk by Jack Boardman of the Interstate Commission on the Delaware River Basin on Pollution Abatement in the Delaware River; a late afternoon inspection of Philadelphia's Water Distribution System Analyzer, coupled with an evening session with Max Barofsky and Ralph Hoot, both of the Philadelphia Sewerage System and Treatment; and, lastly, a discussion by Richard S. Mark, assistant regional engineer, Region II, of the U. S. Public Health Service on radioactive wastes disposal.

In February the **Rhode Island Section** sponsored a series of three lectures on Ultimate Strength of Reinforced Concrete. The lectures, given by John J. Hogan, consulting engineer to the Portland Cement Association, in the Providence Public Library, proved very popular with members.

At a recent meeting of the **Marysville Branch** of the **Sacramento Section** Leonard Hollister, project engineer for the California Division of Highways on the Carquinez Bridge, discussed the problems in design and construction of the bridge. Grant A. Engstrom was recently elected president of the Section's **Shasta Branch**. Its other new officers are Joseph E. Patten, vice-president; Edward E. Delano, secretary; and Frank Bernard, treasurer.

Massachusetts Section officers discuss plans for Society's Boston Convention to which the Section will be host in 1960. Shown here are Prof. Ernest L. Spencer, retiring president and reelected secretary-treasurer; President Ernest A. Dockstader; general Convention committee chairman, William H. Mitchell; and Frank A. Marston, former Vice-President from Zone I.

Gerald W. Johnson, head of Operation "Plowshare," the Atomic Commission's program to demonstrate peaceful uses of atomic explosives, at the University of California Radiation Laboratory in Livermore, addressed the **San Francisco Section's** February meeting. Dr. Johnson explained the uses of nuclear explosives in creating harbors and for other large-scale earthmoving operations. A movie on the detonation of a nuclear device equal to 10,000 tons of TNT was of particular interest since the A.E.C. plans to use a similar explosion to recover oil from shale rock in Colorado late this summer. New officers for the **San Jose Branch,** installed at a recent meeting are: Morris M. Viele, president; John P. Prendergast, vice-president; and Jorge Barriga, secretary-treasurer.

The annual winter meeting of the **South Carolina Section** was held jointly with the South Carolina Society of Engineers in Columbia recently. The meeting consisted of two technical sessions, a business meeting, luncheon and banquet. At the technical sessions Dr. A. J. Chenny, Poly-Chemical Division, E. I. du Pont de Nemours & Company, Inc., Wilmington, Del., spoke on "Plastics as Engineering Material;" R. Hunter Kennedy, director of atomic development, S. C. Electric & Gas Company, Colum-

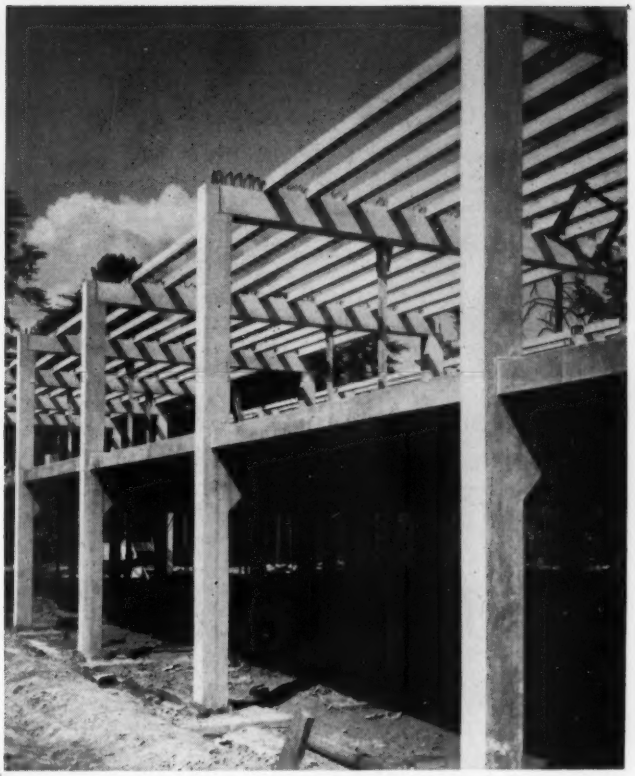
# PRECAST CONCRETE

## MADE WITH

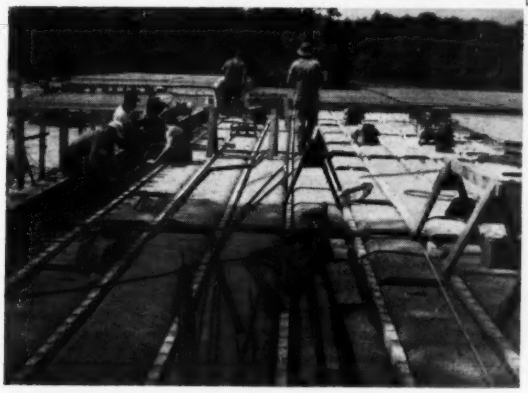
# Lehigh Early Strength Cement

## FOR MODERN FIRESAFE SCHOOL

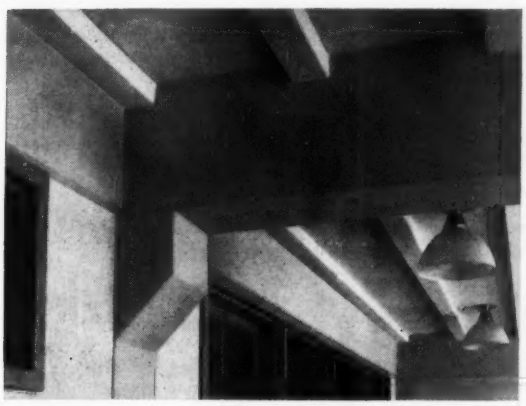
Walter Hines Page Senior High School, Greensboro, N. C.
*Architect:* McMinn, Norfleet & Wicker, Greensboro, N. C.
*General Contractor:* Brooks Lumber Co., Greensboro, N. C.
*Contractor for Precast Units:* Arnold Stone Co., Greensboro, N. C.



*The 95,000 square feet of roof and floor area in this school is supported by 4,200 feet of columns and 4,500 feet of beams* . . . all precast concrete.



*Concrete filler block laid between precast joists ready to receive concrete to complete floor.*



*Interior closeup shows neatness of exposed precast concrete structural system.*

• Low maintenance . . . fire safety . . . long life . . . neat appearance. These are advantages of precast structural concrete construction. And equally important, units are quickly cast to specification, ready for delivery when needed. Erection is quick and easy.

In precasting the various units for this school, Lehigh Early Strength Cement was used to achieve maximum production efficiency and economy.

"Structural members were cast one day and stripped from their forms the following day and moved to storage," writes Mr. M. A. Arnold of the Arnold Stone Company. "By using Lehigh Early Strength Cement, the precasting operation was completed in half the time required had we used regular portland cement."

This is typical of the advantages of Lehigh Early Strength Cement in modern concrete construction.

• LEHIGH EARLY STRENGTH CEMENT • LEHIGH PORTLAND CEMENT
• LEHIGH MORTAR CEMENT • LEHIGH AIR-ENTRAINING CEMENT

**LEHIGH PORTLAND CEMENT COMPANY**
**Allentown, Pa.**

**At post-Convention tour in Honolulu, following ASCE Convention in Los Angeles, are ASCE Past-President Louis R. Howson with Edward J. Morgan (center) manager and chief engineer of the Honolulu Board of Water Supply and president of the Hawaii Section, and the Hon. Neal S. Blaisdell, right, mayor of the City and County of Honolulu.**

bia, S. C., on "Status Report-Parr Nuclear Power Plant;" and H. M. Glenn, chief structural engineer, Oak Ridge National Laboratory, Oak Ridge, Tenn., on "High Density Concrete." The business meeting elected Marcus B. Hunder, president; Doyle D. Gillespie (two years), vice-president; and Albert E. Johnson (two years), secretary-treasurer. A petition from members of the Savannah River Branch of the Georgia Section to become a Branch of the South Carolina Section was approved.

The **Spokane Section's** February meeting drew a large crowd which heard a panel discussion on water rights and water use in the area. Kermit Rudolf, a Spokane attorney for several irrigation districts, was the first speaker. Section members, Earl Smith and Karl Strenge, followed, presenting the points of view of U. S. Geological Survey and Washington Water Power Company, respectively.

## ASCE CONVENTIONS

**CLEVELAND CONVENTION**

Cleveland, Ohio
Hotel Cleveland
May 4-8, 1959

**ANNUAL CONVENTION**

Washington, D. C.
Hotel Statler
October 19-23, 1959

**NEW ORLEANS CONVENTION**

New Orleans, La.
Jung Hotel
March 7-11, 1960

## TECHNICAL DIVISION MEETINGS

**JET AIRPORT CONFERENCE**

Houston, Tex.
Shamrock-Hilton Hotel
May 20-22, 1959

*Sponsored by*
ASCE Air Transport Division
Houston Branch of
Texas Section

**HYDRAULICS CONFERENCE**

Fort Collins, Colo.
Colorado State University
July 1-3, 1959

*Sponsored by*
ASCE Hydraulics Division
Colorado Section
Colorado State University

## DISTRICT CONFERENCES

**NEW ENGLAND CONFERENCE**

Storrs, Conn.
University of Connecticut
April 14

*Sponsored by*
New England Sections

**ASCE Membership as of March 9, 1959**

| | |
|---|---|
| Members | 10,351 |
| Associate Members | 14,720 |
| Junior Members | 17,157 |
| Affiliates | 79 |
| Honorary Members | 43 |
| Total | 42,350 |
| (March 10, 1958 | 40,703) |

## LOCAL SECTION MEETINGS

**Central Pennsylvania**—Annual dinner meeting at Vans Colonial Restaurant in Harrisburg, May 13, at 6 p.m.

**Illinois**—Weekly luncheon meetings, the Engineers' Club, Chicago, every Friday at 12 noon.

**Los Angeles**—Dinner meeting of the San Bernardino-Riverside Counties Branch at Mike's Grill, Riverside, April 21, at 6:30 p.m.; social hour and dinner meeting of the Santa Barbara-Ventura Counties Branch at the El Presidio Restaurant, Santa Barbara, April 21, at 6:30 p.m.

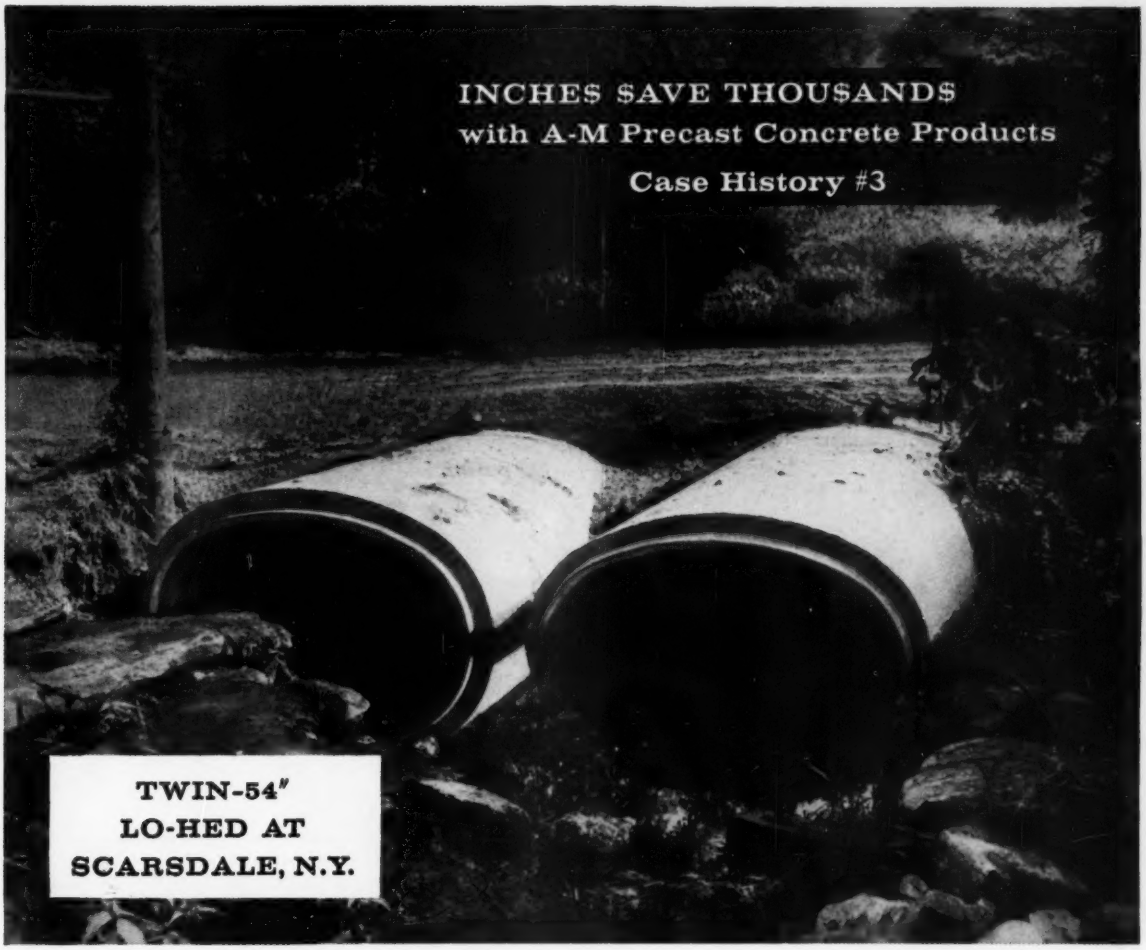
**Maine**—All-day meeting at University of Maine, Orono, April 25.

**Metropolitan**—Meeting in the Engineering Societies Building, April 15, at 7 p.m.; technical soils seminar group of the Junior Member Forum in the Conference Room of the Engineering Societies Building, May 6, at 7 p.m.

**Tennessee Valley**—Spring meeting at Muscle Shoals, April 24-25. Program includes a field trip to the new Wilson Lock and Bridge which are near completion.

**Texas**—Spring meeting at Corpus Christi, April 30-May 2; regular meetings of the Austin Branch at the Austin Engineers and Associates Club the third Thursday of each month, at 7 p.m.; meetings of the Dallas Branch at the Hotel Adolphus the first Monday of each month, at 12:15 p.m.; meetings of the Fort Worth Branch at the Hilton Hotel the second Monday of each month, at 12:15 p.m.

**Virginia**—Norfolk Branch meeting at the YMCA Cafeteria the third Monday of each month, at 12 noon; Richmond Branch meeting at the Hot Shoppe Cafeteria the first Monday of each month at 12:15 p.m.; Roanoke Branch meeting in the S & W Cafeteria the second Wednesday of each month, at 6:30 p.m.




# LO-HED CUTS CULVERT COSTS 3 WAYS

- **INITIAL COST**—two Lo-Hed culverts carry more water than three round pipe lines of the same height—putting every square inch to best possible use.

- **CONSTRUCTION COST**—two Lo-Hed culverts require less excavation, handling and jointing than three or four round pipe lines.

- **MAINTENANCE COSTS**—two Lo-Hed culverts, each with larger unobstructed area, pass more debris, giving yearly bonuses in required maintenance.

**AMERICAN-MARIETTA COMPANY**
**CONCRETE PRODUCTS DIVISION**
GENERAL OFFICES:
AMERICAN-MARIETTA BUILDING
101 EAST ONTARIO STREET, CHICAGO 11, ILLINOIS, PHONE: WHITEHALL 4-5600

# BY-LINE WASHINGTON . . . . .

**Congressmen just can't seem to get interested** in the fate of the mammoth multi-billion-dollar Interstate System which, officials declare, must have a quick charge of new money or work will definitely be curtailed.

*Big problem is* that the 1956 Congress included a provision that the Interstate program be "pay-as-you-go," and that apportionments to the states be limited to highway-user revenues into the Highway Trust Fund. Last year, Congress voted to lift this limitation to permit a full authorization of $2.2 billion. But the law still reads that the money must be paid back before new apportionments are made. This means that unless the national legislators do something soon, there will be no apportionment at all this summer for Interstate work, and only $500 million next year, instead of the previously authorized $2.5 billion for each of these years.

*Highway leaders have cause to be concerned.* Almost no one on the Hill wants this curtailment to occur; as of now, almost no one has gone to bat for a definite acceptable solution.

* * *

**For some time, scientists and engineers have been calling** for a Cabinet-level Department of Science and Technology. Last month, Senator Hubert Humphrey introduced a bill designed to create such an arm of the federal government. It would include all such groups as the Atomic Energy Commission and the National Aeronautics and Space Administration, and eventually take in engineers working in water resources, science and technical information, mapping, geodesy, and other areas.

* * *

**Fearing a Presidential veto** of their original airport construction hopes, members of the House Commerce Committee drastically reduced their proposal to $297 million. This is still $97 million above what the Administration recommended, but far below the $465-million bill passed earlier by the Senate and the $565 million originally proposed.

*The four-year measure was amended,* also, to make sure none of the funds would go for what the President described as fancy passenger terminals and cocktail lounges. There is general agreement that the federal-aid program should concentrate on design and construction of runways and other basic airfield facilities. The bill also contains a provision that the federal-aid money must be picked up within two years after approval of a project.

* * *

**The Battle of the Great Lakes has resumed.** The City of Chicago has appealed to Congress for permission to pump a total of 2,500 cfs of water from Lake Michigan to carry its treated waste into the inland waterway and maintain "adequate" levels for shipping on that facility. Currently the city's sanitary engineers are diverting 1,500 cfs of water for these purposes.

*Vigorously opposing the proposal* are the dozens of other cities around the Great Lakes, including the Canadian. They maintain that the Chicago diversion will lower the levels of all five of the big lakes, interfering with shipping, rendering docks useless, and forcing them to expend millions of dollars for dredging. A substantial number of Congressmen are involved in the fracas which is expected to become one of the fiercest of this session.

* * *

**Photogrammetrists are hailing** as "most commendable" the recent recommendation of ASCE that surveying and mapping be considered a civil engineering function. The Association of Professional Photogrammetrists here was quick to support the Society's position. Alfred O. Quinn, chairman of the APP, and one of the ASCE Task Group that studied the policy, called on photogrammetrists to do all they can to implement the ASCE decision.

*"Clients are bound to receive higher quality* photogrammetric services under the traditional engineering relationship," he declared. "We can all look forward to a general upgrading of this vital mapping function as the ASCE recommendation becomes widely recognized and implemented."

* * *

**A quick review of the Bureau of Reclamation's** 1959 construction program finds that the big contracting agency currently has about $340 million worth of work under way, comprising 170 contracts. The job list shows 15 dams in the works, two power plants, 19 pumping plants, 100 miles of main canal, 200 miles of laterals and pipelines, and 480 miles of high-voltage power transmission lines. The agency plans to let $115 million worth of new work this year.

* * *

**The missile program will start to go underground** this year. Military strategists hope to install most of the "second generation" missiles in huge complexes beneath the surface. About eleven of these so-called "hardened" bases are to be constructed at scattered locations around the country for the Titan ICBMs.

*An underground complex will be composed* of three massive silos to house the missiles, interconnected control center, propellant and equipment terminals, a powerhouse, portals, and antenna silo. The underground network would be about 1,300 ft across. There would be three on each base, widely separated, perhaps as much as 18 miles apart.

* * *

*Off the cuff at press time . . .*

Mechanization of post offices is stimulating new designs for this kind of federal building. A $20-million structure to be built in Providence, R. I., is the forerunner of more innovations in this area, officials say. . . . Senator Warren Magnuson of Washington has called for a detailed study of a proposed 32-mile inland ship canal between Seattle and Tacoma. Such a project, he believes, would open up thousands of acres of sites for industrial development. A preliminary study by the Corps of Engineers has envisioned a canal sized at 300-ft bottom width and 40-ft depth, with 1,000-ft-long locks, 100-ft wide. The estimated cost—$146 million. . . . A new study of sewage treatment plant costs is under way in the U. S. Public Health Service. Its objective—to permit city and public works officers to estimate the current cost of needed facilities.

"With high-strength bolts you can erect steel quietly, economically, and quickly. Bolts also provide a better means of taking advantage of semi-continuous steel framing, which is a seven per cent tonnage saver in steel construction."

ROWLAND S. ROSÉ, COOPER & ROSÉ & ASSOCIATES, STRUCTURAL ENGINEERS, PORTLAND, OREGON

*Architects:* Stanton, Boles, Maguire & Church. *Structural Engineers:* Cooper & Rosé & Associates. *General Contractor:* Hoffman Construction Company. *Steel Erection:* Pacific Car & Foundry.

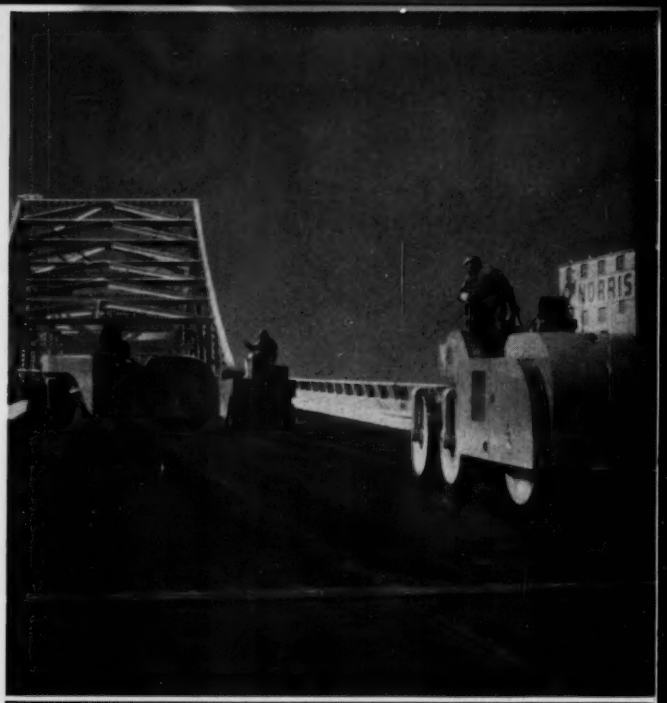
Executive Building, Pacific First Federal Savings & Loan Association, Owner, Portland, Oregon. Some 10,500 Bethlehem High-Strength Bolts were used to join its 485-ton steel framework.

Bethlehem High-Strength Bolts are made of carbon steel. They are quenched and tempered to meet the requirements of ASTM Specification A-325. Plan to use them on your next job.

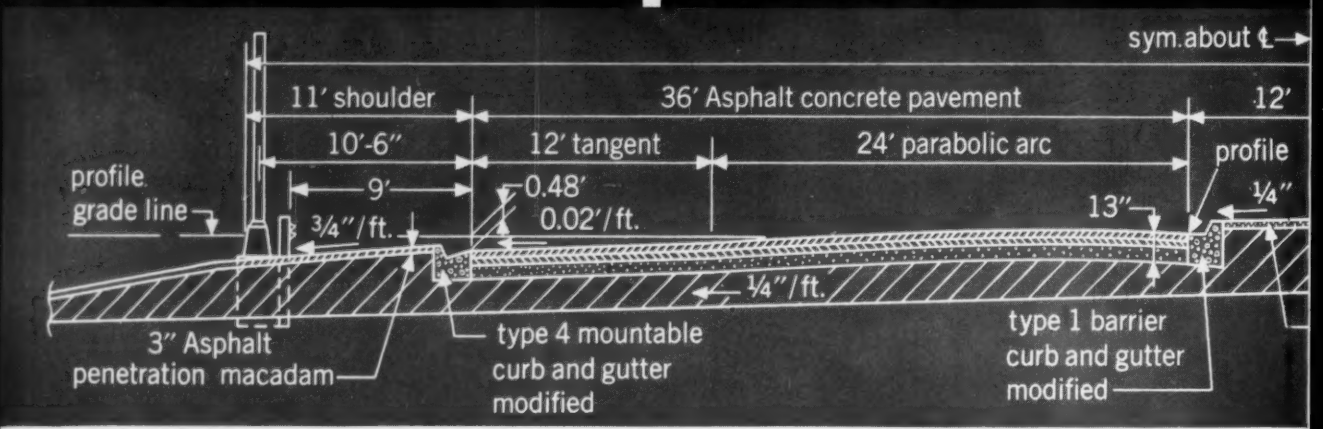
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

**BETHLEHEM STEEL**

**To lay Asphalt concrete on bridge decks in winter** the contractor used three, 12-foot finishing machines. By paving simultaneously cold longitudinal joints were prevented. Finishers were followed immediately by 2- and-3-axle tandems.




**One-inch binder course is compacted by tandems.** Self-propelled pneumatic-tired roller ballasted with ten tons of sand complete compaction. Ordinary household detergent in water prevented Asphalt pick-up by rubber tires of the heavy equipment.




*Chicago's Calumet Skyway proves it!*

# Modern, durable, Asphalt paving

Paving of the Windy City's 7.7 mile Calumet Skyway; an elevated, twin-36-foot-lane toll facility; started in October 1957. By April 16, 1958... just six months later... it was opened for traffic.

Mind you, the job was done in midwinter and had to be paced to the completion schedules of fill and bridge sections.

**It is safe to say that when laid down in midwinter at this speed only modern Asphalt concrete construction could have satisfied the engineering standards for this pavement structure. Competitive bidding established that Asphalt concrete was also the least expensive material.**

To the direct construction savings, resulting from the speed and low cost of Asphalt paving, must be added extra revenue realized by the ability to open this toll facility in time for 1958 summer traffic.

The road's designers point out that modern Asphalt construction also provides the desired durability, minimum maintenance, minimum traffic noise, fast melting of snow and ice with no trouble from deicing salts.

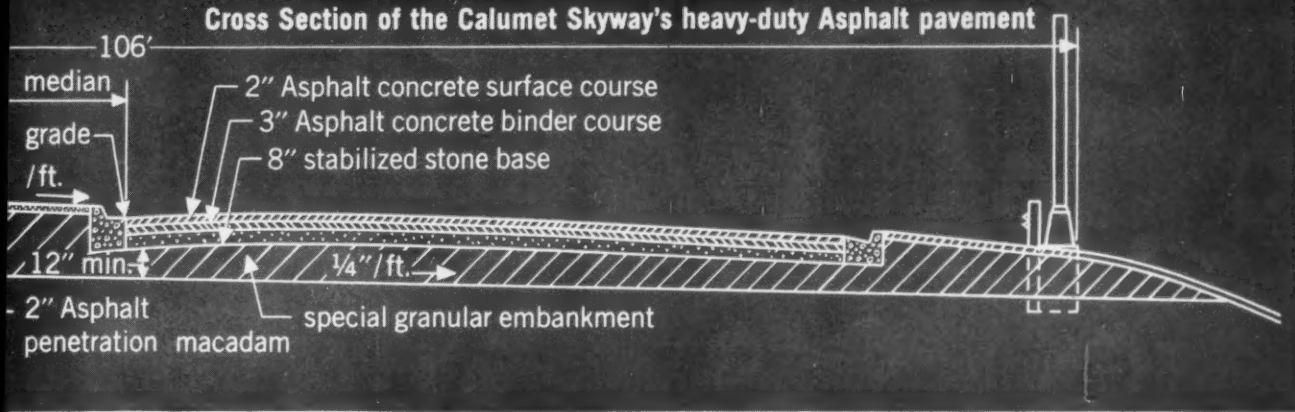
**Asphalt concrete is easily the most versatile paving material.**

In this example Asphalt concrete proves out on 18-foot

**Specially-equipped trucks bring mix to finishers.** Insulated truck beds and tarpaulin covers protect mix, bring it to job at best laying temperature. Canvas aprons on spray bars of distributors keep prime from blowing on curbs and sidewalks.

**Before and after rolling,** luteman, raker and straightedge man check the mat. Despite 2-inch high expansion and contraction plates every 100 feet, mat goes down true to grade. A 13-20 ton roller irons wearing surface to final smoothness.

**Cross Section of the Calumet Skyway's heavy-duty Asphalt pavement**




# is done at record, tax-saving speeds

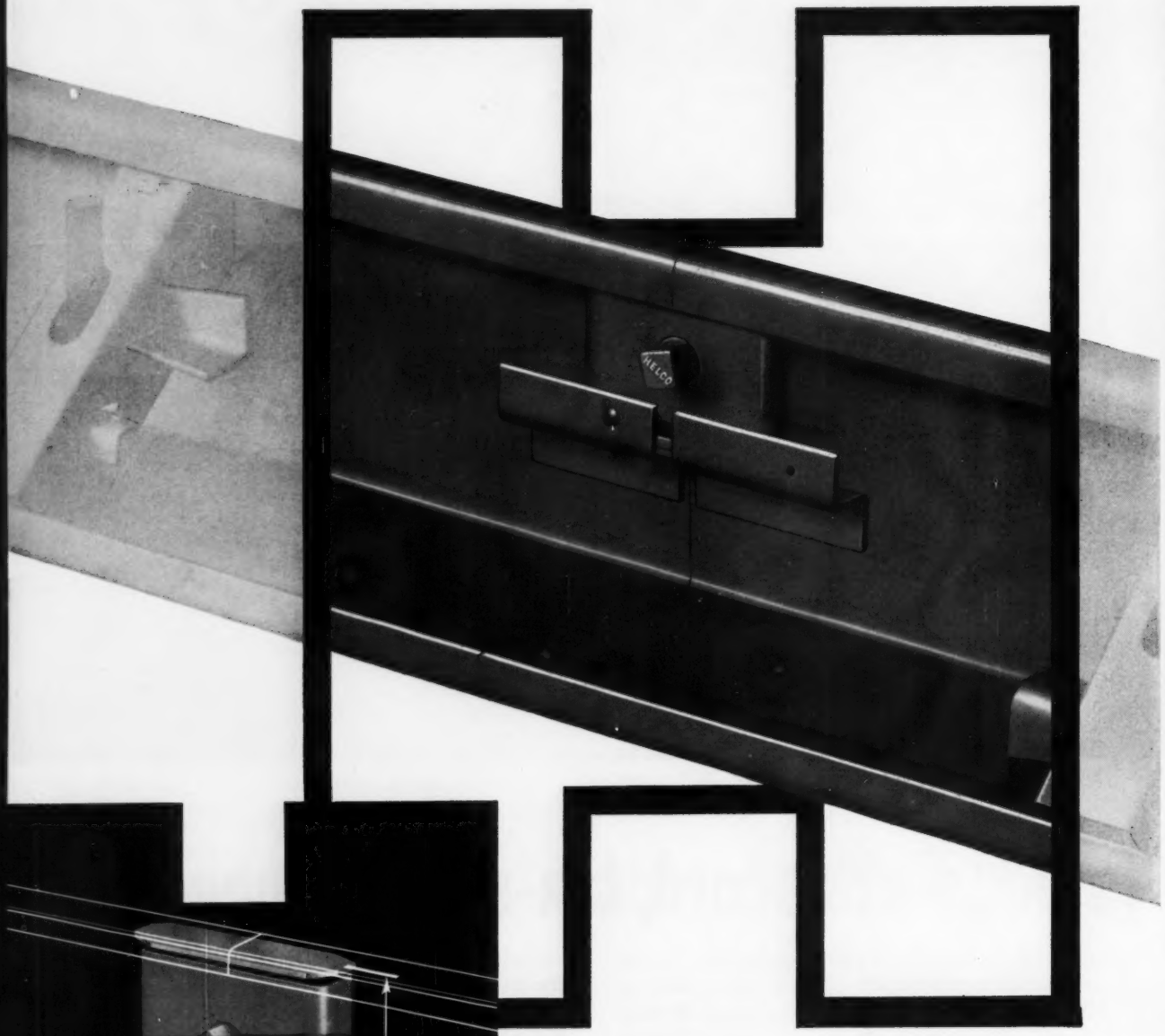
fill and on bridge decking. In Louisiana it is performing well over virtual quagmires. In Ohio, it proves ideal on glacial till. In New England, it has taken years of alternate freezing and thawing in its stride. Along Oregon's rainy coast Asphalt concrete is the only paving that lasts. In the Southwestern desert regions, where eggs can be fried on road surfaces, Asphalt concrete is by far the preferred pavement. In mountainous terrain, Asphalt concrete is the easiest material to lay and it conforms to foundation settlement without fracturing. In New Jersey, it was selected to handle the world's heaviest turnpike traffic loads ... 4,012,815 vehicles in July 1958 alone.

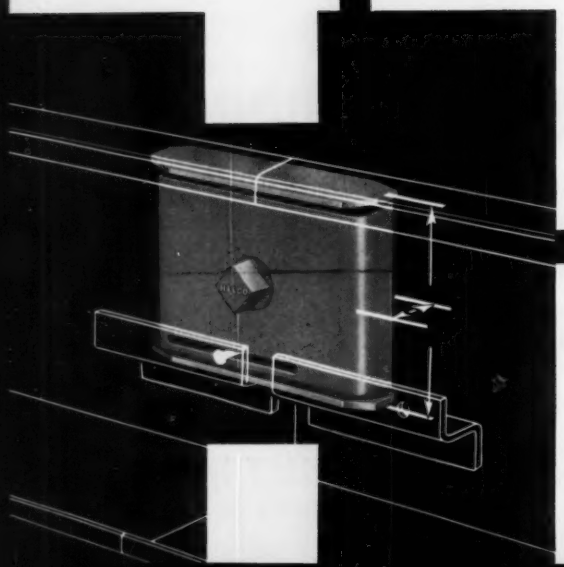
Under all these conditions and more, modern Asphalt concrete has proved itself the least costly pavement to build and to maintain. When you specify it, you make your state's road-building tax funds go **much** further.

*Ribbons of velvet smoothness ...*
***ASPHALT**-paved Interstate Highways*

**THE ASPHALT INSTITUTE**
**Asphalt Institute Building, College Park, Maryland**

# HELTZEL'S NEW *Cam-Lok



The cam expands the lock both front-to-back and top-to-bottom to align form tread and face simultaneously.

**HELTZEL STEEL**

# STEEL FORMS!

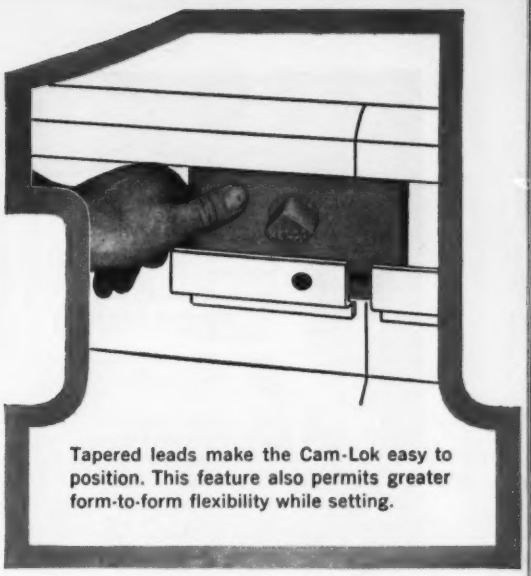
From steel form headquarters—revolutionary new highway forms that go together with absolutely rigid straight-line joints . . . faster, easier than ever before! They're HELTZEL'S NEW **CAM-LOK* STEEL FORMS!

Sturdily constructed on a simple cam principle, the new Cam-Lok slides easily into position. A fast quarter turn of the cam draws the treads of both form sections into alignment—with a joint that can't shake loose regardless of the vertical thrust of the machine weight or the horizontal thrust of spreader and finisher. An open end wrench is the only tool needed. There's no sledging with resulting tread and lock damage—no chance for misadjustment, and the simple cam mechanism is positively non-fouling!

There's more to these new Cam-Lok forms. Full channel stake pockets with angular wedges are stronger and insure better stake retention. They're available in the single or double wedge type with or without upturned flange base. Cam-Lok Highway Forms have a cambered base end and are available for radii forming.

AIRPORT FORMS, too, now come equipped with the fast setting, self-aligning new Cam-Lok. You'll want to know more about this great new idea in highway and airport forms. Write today for your copy of the Heltzel Cam-Lok Bulletin.

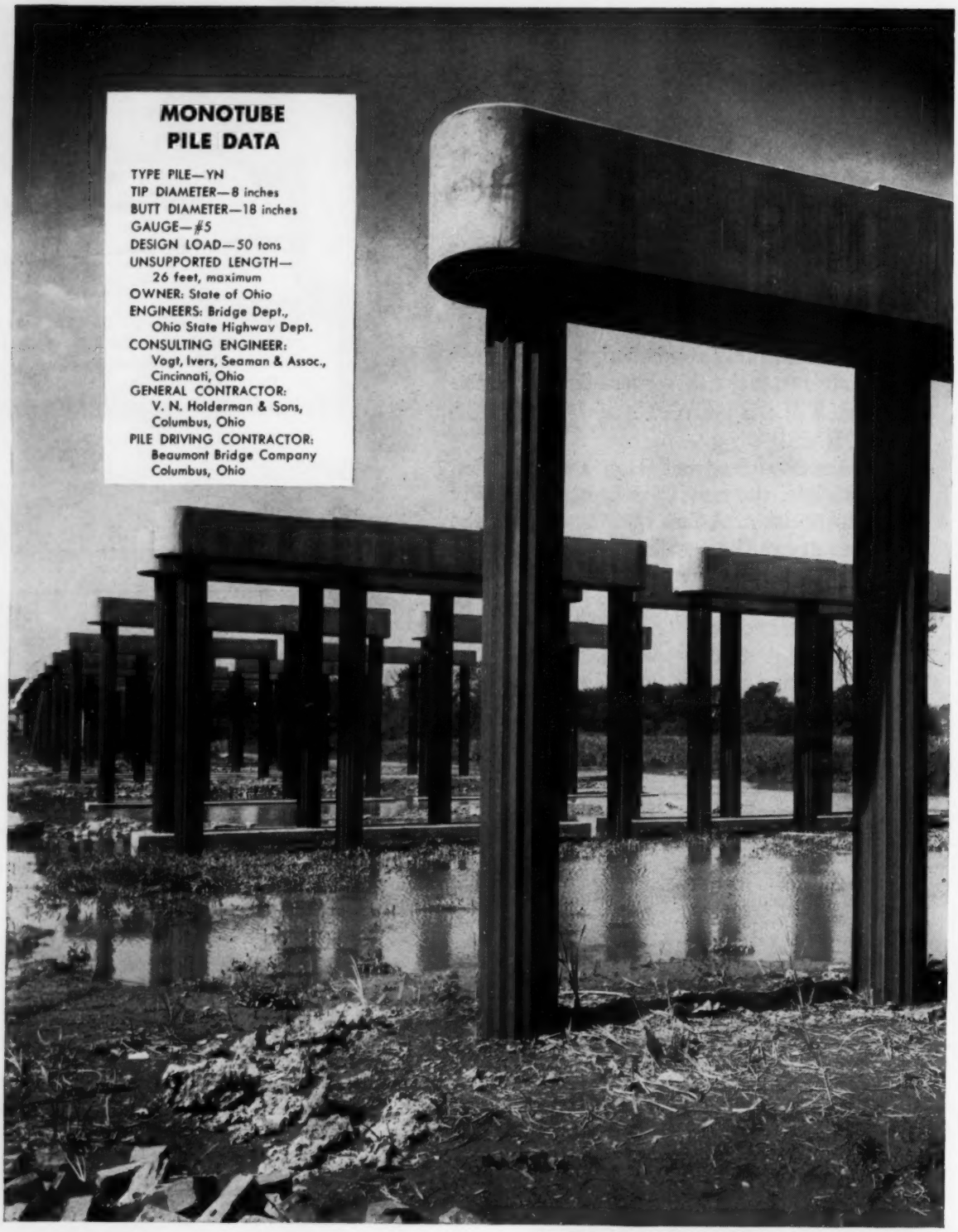
* Patent Pending



Tapered leads make the Cam-Lok easy to position. This feature also permits greater form-to-form flexibility while setting.

A fast quarter turn fully expands Cam-Lok aligning treads and holding them in alignment, until released.

**FORM AND IRON COMPANY** WARREN, OHIO




***VERSATILITY plus ECONOMY*** with Monotube piles. When soil conditions at this site in Mansfield, Ohio, prohibited conventional construction in crossing low-lying land, this adaptation of a foundation supported on Monotube steel piles proved to be an economical solution.

Tapered, fluted Monotube piles are available in lengths, diameters and gauges to meet every requirement. Write The Union Metal Manufacturing Co., Canton 5, Ohio, for complete information.

**UNION METAL**

*Monotube Foundation Piles*

no. 7 OF A SERIES

## A "SOUND" APPROACH TO RIDING COMFORT

***The "tuning out" of excessive shake and vibration by Oldsmobile engineers produces a comfortable, balanced ride that adds thousands of miles to the life of an automobile.***

One of the most critical areas of engineering in today's automobile is "ride". It is critical because an unsatisfactory ride means an unsatisfactory automobile. To produce an over-all balanced and smooth ride, free from harshness and fatiguing vibration, Oldsmobile engineers begin the complex task of "tuning" the car in the early stages of a new model program. Not only is ride important from the comfort standpoint, but an improperly "tuned" car can literally shake itself apart after several thousand miles.

The tuning operation is a series of intricate tests that determine a car's "shake" characteristics—where and how much the metal bends and twists. To produce beaming and torsional moments, a mechanical oscillator is attached to the frame and vibrates the car in a frequency range of 7½ to 15 cycles per second. To measure the displacement of the metal, a velocity pick-up is attached directly to the area under study. As the metal vibrates, a signal is produced by the pick-up and is fed to a vibration meter where it is integrated. The resulting signal is then transmitted to an X-Y plotter that instantly converts it into a continuous magnitude-vs.-frequency trace.

With this valuable information, refining can begin by altering the structure of the various component parts. A complex network of infinite variation must be analyzed intensively to produce the mark of quality that stamps every Oldsmobile.

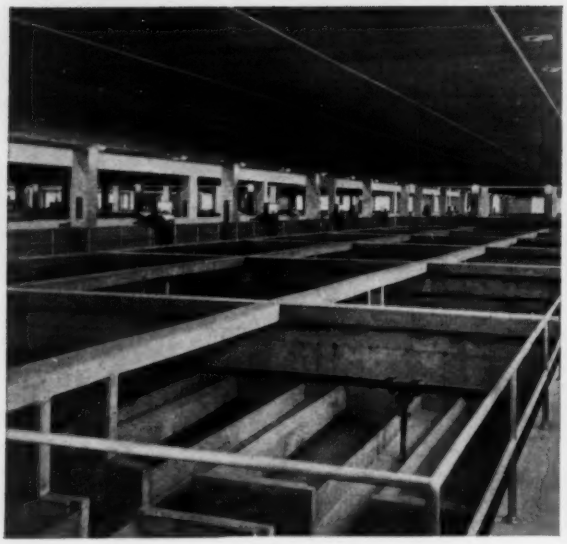
Over the years, Oldsmobile's reputation for quality manufacturing and precision engineering has grown, step by step, until today it is a car of recognized distinction—in a class by itself. Oldsmobile's durability and long service life is further attested to by its continued leadership in resale value. You owe it to yourself to first examine, then test-drive, a truly outstanding automobile—the 1959 Oldsmobile. Visit your Local Authorized Oldsmobile Quality Dealer as soon as possible.

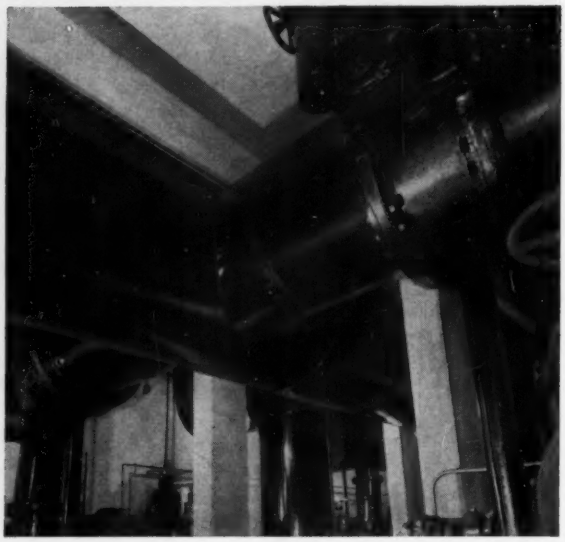
OLDSMOBILE DIVISION, GENERAL MOTORS CORPORATION

**OLDSMOBILE**

**Pioneer in Progressive Engineering ...Famous for Quality Manufacturing**

*Philadelphia's*
*New Torresdale Plant*
*Installs 191*
**ALLIS-CHALMERS**
**VALVES**





At the new 423 MGD Torresdale Pre-Treatment and Rapid Sand Filter Plant, 191 Allis-Chalmers rubber-seated butterfly valves, in sizes from 20 inches to 96 inches, are being installed. Morris Knowles Inc. of Pittsburgh was the Consulting Engineer for the Engineering Bureau of the Philadelphia Water Department on this new, modern water purification plant. When it goes into operation, it will increase both the quality and quantity of water for approximately 62% of Philadelphia's users.

Photos above show a section of the 94 separate filters and the massive filter pipe galleries where the A-C rubber-seated butterfly valves are installed. Compact and easy to operate, these valves have gained a reputation in numerous installations for completely satisfactory performance with only nominal maintenance requirements.

Product information and engineering assistance can be obtained from your nearest A-C valve representative, or by writing Allis-Chalmers, Hydraulic Division, Valve Department, York, Penna.

*Hydraulic Division* RESEARCH DESIGN HYDRODYNAMICS ENGINEERING FABRICATION

Rotovalves • Ball Valves • Butterfly Valves • Free-Discharge Valves
Hydraulic Turbines & Accessories • Pumps • Liquid Heaters

A-C ALLIS-CHALMERS

**ALLIS-CHALMERS**

"PRESSURE-TREATED WOOD" SPECIFICATION FILE

TEAR HERE FOR FILING

# Pressure-Creosoted Wood for Highways Stretches Tax Dollars

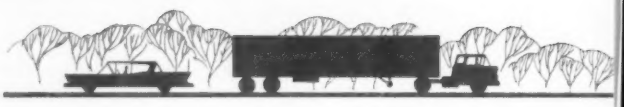
Pressure-creosoted wood is an accepted and proved material for guardrail posts, lighting poles, fence posts, and sign posts. For these accessories and other highway construction such as bridge and foundation piling, you need a material that is low in first cost and low in maintenance costs . . . a material that is attractive, strong and durable . . . one that resists weather, insects and fungi.

Pressure-creosoted wood offers all these advantages. Wherever foundations, supports or bridge pilings are needed, pressure-creosoted piling often makes possible substantial savings—releasing funds for other construction.

USS Creosote

**Merritt Parkway, Connecticut**—Pressure-Creosoted domed-top posts with reflector buttons and steel cables provide attractive, strong, safe guardrails.

# Recommendations for specifying pressure-creosoted wood



*This material was taken in part from a report by the Highway Committee on the American Wood Preservers Institute.*

**LUMBER**—For load-bearing structural members use any species of stress-rated lumber; that is, lumber that has been graded for the assignment of working stresses. Grading of structural lumber for stress rating should comply with American Society for Testing Materials designation D-245, *Methods for Establishing Structural Grades of Lumber.*

Sizes of sawed lumber, rough or dressed, should conform to American Lumber Standards.

Lumber and timber may be ordered rough or surfaced. Where surfaced lumber is ordered, a standard dressing—S2E, S2S or S4S—should be specified. A timber surfaced on two sides, S2S, has the same thickness as that surfaced on one side only.

The great bulk of stress-rated or structural lumber and timber is manufactured from southern pine and from West Coast woods—Douglas fir, hemlock. Standard grading rules for the southern pines are published by the Southern Pine Assn., P.O. Box 1170, New Orleans 4, Louisiana, and for Douglas fir and western hemlock by the West Coast Lumbermen's Assn., 1410 S.W. Morrison St., Portland 5, Oregon.

**BRIDGE AND STRUCTURAL LUMBER**—Select from the applicable regional rules a suitable grade of lumber or timber; specify species, show the pertinent paragraph number; and designate the grading rules to which reference is made.

**PRESERVATIVES**—Creosote is the preservative most extensively used for treating wood in contact with the ground. Creosote-coal tar solutions in heavy retentions are recommended for timber exposed to marine borers.

The purchase order or specification for pressure-creosoted wood should set forth clearly:

1. The preservative and the specifications (AASHO, AWPA, or Federal) to which the preservative must conform.
2. The final net retention of creosote per cubic foot of wood.
3. The specification or standard with which the pressure-treating process must comply. (Again use AASHO, AWPA, or Federal.)

Information on the quality of wood acceptable for treatment also should be stated explicitly:

1. Lumber—grade, species and regional grading rules.
2. Round timber piling—length, species, and specification with which compliance is required.
3. Round timber poles (lighting)—species, ASA class and length. Quality and physical properties should be required to meet ASA standards.
4. Round timber posts.

   (a) Guardrail posts—Specify minimum diameter, species of wood acceptable, and any special framing requirements.

   Note: Adherence to established standards for size and length that are proving satisfactory in most states will promote economy.

   (b) Round timber fence posts—Specify minimum diameter, length, and acceptable species.

   **Note:** *Posts for distribution throughout the country are produced under specifications issued by the Farm Fencing Association in a range of sizes adapted to all types of fencing.*

**INSPECTION**—The purchaser, where practicable, should designate an experienced inspector to see that timber, preservative and treatment comply with specifications.

Lumber and sawed timbers should be graded at the point of origin. Grading shall be done and a certificate of inspection issued—(a) For southern pines by the Southern Pine Inspection Bureau and (b) For Douglas fir and West Coast species by the West Coast Lumber Inspection Bureau.

Inspection of lumber and sawed timbers should be made by one of the inspection bureaus named above at mill origin. Round timber products and all treating results shall be inspected at the treating plant by an approved inspector. Such inspections and acceptance should be final.

Inspection of round timber products and of all treating operations by highway personnel is recommended. Where experienced highway personnel are not available for this purpose, an approved inspection agency should be retained.

**FOR FURTHER INFORMATION**

Send for our new, FREE booklet, "Pressure-Creosoted Wood for Highways." This booklet contains a bibliography and tables showing recommended treatment for various kinds of wood. For your free copy of this informative booklet, just send the coupon below.

**OTHER INFORMATION**

Any of the following material can be had by writing to the respective source.

Information on the most effective use of pressure-creosoted wood is available from United States Steel (525 William Penn Place, Pittsburgh 30, Pa.):

A Report on Pole No. 92159
Electrical Resistance of Wood Poles
Pressure-Creosoted Poles Pay
Supplemental Field Treatment of Poles
Fences That Pay
Build and Save
Pole Buildings for Machinery Storage

The American Wood Preservers Institute (111 W. Washington Street, Chicago 2, Illinois) also offers a number of booklets plus engineering assistance to highway engineers on request:

Pressure-Treated Foundation Piles
Pressure-Treated Timber Poles
How to Design Pole-Type Buildings
Forest Products Laboratory Report No. 2043
How Pressure-Treated Lumber Stretches Park Budgets (reprint from Grist)
Wood Preserving News (Monthly)

Requests for the following literature should be addressed to the sources shown, with checks or money orders where prices are indicated:

Standard Specifications for Highway Bridges, published by the American Association of State Highway Officials, 917 National Press Building, Washington 4, D.C.

National Electrical Safety Code, for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Price $1.75.

American Standard Specifications and Dimensions for Wood Poles, published by American Standards Association, 70 East Forty-fifth Street, New York 17, New York. Price 50c.

Standard Specifications for Round Timber Piles, ASTM Designation: D-25, latest edition, published by American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.

**LUMBER GRADING RULES**

Grading Rules for Southern Pine Lumber, issued by Southern Pine Inspection Bureau, National Bank of Commerce Building, New Orleans 4, La.

Standard Grading and Dressing Rules, issued by West Coast Lumber Inspection Bureau, 1410 S.W. Morrison Street, Portland 5, Oregon. Price 50c.

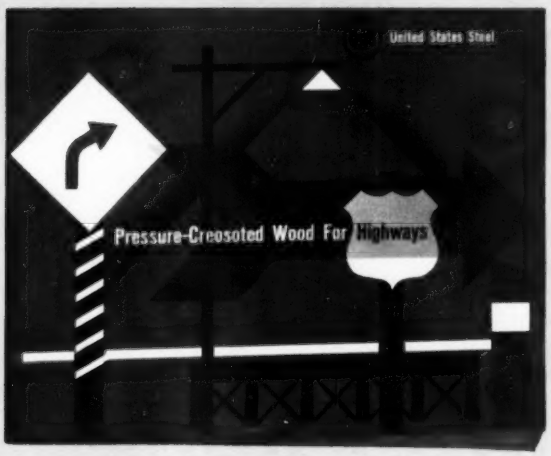
**TREATING SPECIFICATIONS**

Manual of Recommended Practice, American Wood Preservers Association, 839 Seventeenth Street, N.W., Washington 6, D.C. Complete manual $8.00; 45 Individual Standards, (loose leaf sheets). 5c each.

Federal Specification—Wood Preservative: Treating Practices—TT-W-0057Id, General Service Administration, Washington, D.C.

*USS is a registered trademark*

USS Creosote




FOR THIS FREE BOOKLET
SEND THIS COUPON

**United States Steel**
**525 William Penn Place**
**Pittsburgh 30, Pa.**

*Gentlemen:*

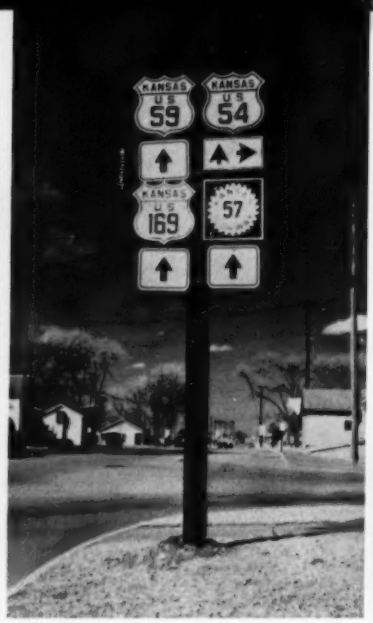
*Please send me a copy of "Pressure-Creosoted Wood for Highways."*

**Name**_____

**Company**_____ **Address**_____

**City**_____ **Zone**_____ **State**_____

**Kansas**—Right-of-way fence posts of pressure-creosoted wood are strong, easily installed and low in cost.




**Kansas**—Pressure-creosoted poles provide durable, low-cost and low-maintenance supports for signs.

Pressure-creosoted poles for lighting standards are low in cost.

# Poles and Posts—life expectancy 35 to 40 years

A recent survey of engineers in more than 50 major utility companies in 27 states indicates that the service life expected from today's pressure-creosoted poles is between 35 and 40 years—*without maintenance.*

Pressure-creosoted highway sign posts and fence posts have shown equally good service and excellent resistance to brush fires, whereas untreated posts decay at the ground line and are easily destroyed by fire.

**Ohio**—Modern, three-level viaduct extension with pressure-creosoted timber foundation designed for a load of 35 tons per pile.

**Massachusetts**—Pressure-treating with creosote-coal tar solution protects these bridge piles against marine organisms and the wetting and drying of salt water tides.

# Foundation and bridge piling—solid, safe, and low in cost

Pressure-creosoted piles provide permanent, economical foundations for bridges, viaducts and other structures. Service records kept over 70 years *prove* that buried foundation piles do not decay regardless of the cutoff height above the water table. Load tests prove they will support 25 to 35 tons—about the same as piles of other materials.

In salt water applications, pressure-creosoted piles have consistently demonstrated their resistance to attack by marine borers and other organisms such as teredo or limnora. Heavy retentions of creosote-coal tar solutions are superior for this application.

USS Creosote

*A new table-top Whiteprinter at a new low price*

# The versatile REPROFAX VIKING

**The Reprofax Viking** *handles up to 80% of technical print requirements* in average industrial copying operations. This table-top Whiteprinter has a full 18-inch width for reproducing drawings up to 18 inches wide by any length. It processes prints with speeds up to 18 feet per minute . . . production performance that can't be matched in its price class!

**Look at these Viking features:** no venting required • cool, odorless, quiet operation • plug in to any standard 115-volt outlet • full developer coverage at all speeds for sharp copies every time.

**And the Viking is perfect** *for supplementary use* in high-volume print rooms, too! The Viking is simple to operate. You can locate it anywhere.

**Let us show you** how the Viking can go to work for you. Simply mail the coupon today.

**Reproduction Products Company**
**12790 Westwood Avenue, Dept. QQ-4**
**Detroit 23, Michigan**

Please send me your free folder with complete details on the Reprofax Viking.

Name_____

Position_____

Company_____

Address_____

**REPROFAX® PRODUCTS**
**REPRODUCTION PRODUCTS CO. • A SUBSIDIARY OF**
**OZALID**
**A DIVISION OF GENERAL ANILINE & FILM CORPORATION**

*Sewer Repair, Prichard, Alabama*

## MORETRENCH WELLPOINTS CAN MAKE YOUR WET JOB LOOK LIKE THIS...

## HERE'S HOW:

**1.** An experienced engineer studies your project, estimates the amount of wellpoint equipment needed to predrain it *properly*, plans the system to facilitate your plan for job progress.

**2.** A trained demonstrator installs the system carefully, instructs your men in its operation, remains on the job until it's going ahead "in the dry".

**3.** From start to finish, each job receives individual attention. Because of this,and superior equipment, less units do the work – in shorter time – with correspondingly *lower final costs*. Results are guaranteed.

This procedure, followed consistently for thirty five-years, has been responsible for our constant growth and progress in the wellpoint industry.

If you'd like further information on what a Moretrench Wellpoint System can do, send for our catalog.

**MORETRENCH CORPORATION:**

Without obligation, please send me your catalog, "The Moretrench Wellpoint System".

Name_____

Firm_____

Address_____

_____

# MORETRENCH CORPORATION

| 90 West St. | 4900 S. Austin Ave. | 7701 Interbay Blvd. | 315 W. 25th St. | Rockaway |
|---|---|---|---|---|
| New York 6 | Chicago 38, Illinois | Tampa 9, Florida | Houston 8, Texas | New Jersey |
| CO 7-2283 | Portsmouth 7-4212 | Tampa 61-1881 | Underwood 4-7774 | Oakwood 7-2100 |

Western Representative: Andrews Machinery of Washington, Inc., Seattle 4, Washington

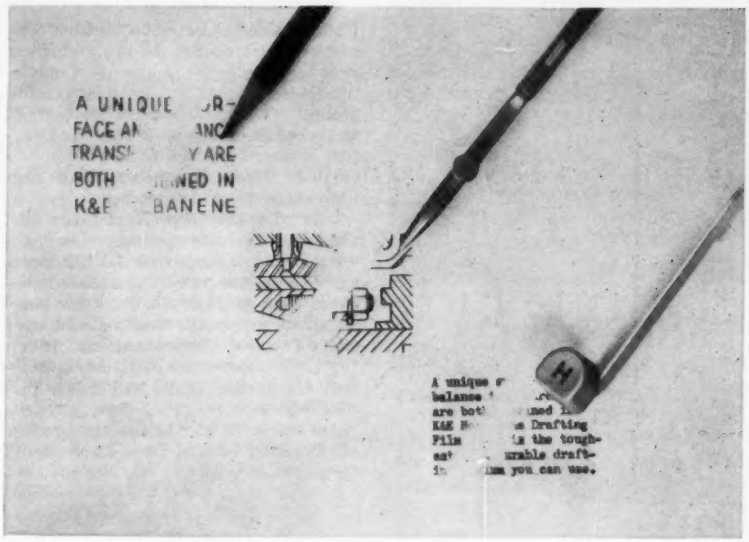
Canadian Representative: Geo. W. CROTHERS Limited, Toronto, Ontario

Brazilian Representative: Oscar Taves & Co., Ltd., Rio de Janeiro

# Some Ideas

for your file of practical information on drafting and reproduction from

**KEUFFEL & ESSER CO.**




Now you see it . . . now you don't. Pencil, ink and typing all register sharply, erase completely on the K&E "engineered surface."

### The K&E "Engineered Surface"

All K&E paper, cloth and film has one extremely individual characteristic. It's what K&E calls its "engineered surface"... a unique surface designed and applied by K&E, right in its own plant, to every roll and sheet of prepared tracing paper, cloth and film. It means controlled drafting qualities far beyond anything the base material alone can normally provide, with a surface tooth that's exactly right and uniform. Whatever's penciled, inked or typed onto it goes on crisply and sharply . . . shows up clearly and stays that way. Furthermore, the "engineered surface" lets you erase if you want to, easily and quickly and without any of those leftover ghost lines that drive you crazy when they show up in reproductions. And remember, only with K&E do you get all the advantages of an "engineered surface," no matter which paper, cloth or film you're interested in.

### About HERCULENE (TM) The Newest of Films

Frankly, we think K&E Herculene Drafting Film is a real discovery. It has all the properties of the K&E "engineered surface" . . . exceptional "take," adhesion and erasability . . . plus the toughness and durability of its Mylar® base. What's the latter? It's a polyester film, developed by DuPont, that's uncommonly strong and virtually indestructible . . . waterproof and almost immune to the effects of age, heat, ultraviolet exposure and handling. With our K&E "engineered surface" added, it becomes K&E Herculene Drafting Film . . . the toughest, most durable drafting medium yet to reach the drafting room. And the surface will last indefinitely, without flaking off or chipping off.

### Some Points About Paper...

K&E Albanene® Tracing Paper is the largest selling tracing paper in the world today. Why? Because Albanene is the *only* prepared tracing paper which has an "engineered surface." All other brands depend for their pencil tooth solely on the natural surface texture of the paper itself, which varies from fine to coarse . . . often on the same sheet.

Albanene invariably gives you sharp, clear pencil lines, superb reproductions. It has a solid transparentizer that is chemically stable and can't leak out, ever. This permanent transparentizing means that you'll never get white, opaque spots, even from contact with drafting tape. Try the drafting tape test yourself.

### ...and its package

And now, all Albanene paper in rolls is packaged in the new square carton for better protection and easier storage. Your rolls stay neat and clean while in use, and the cartons will do double duty in helping you to store finished tracings. In fact, some companies are rearranging their filing systems by using Albanene cartons, which hold large numbers of rolled-up drawings and stack simply and neatly.

### Some Facts About Cloth

When you want cloth, think first of K&E Phoenix® Tracing Cloth. Besides the K&E "engineered surface" with the superb "take", adhesion and erasability for pencil, ink or typing, K&E Phoenix has all the advantages of a water-resistant, chemically-inert coating that won't soften even under high heat and won't discolor, become brittle or flake off the base. You can even clean both sides with a damp cloth, without worrying about moisture stains.

### And Some Tips On Erasing

All K&E drafting media give you excellent erasability, but there's a right way to erase on each one. On cloth and film, harsh, gritty erasers can destroy the surface. You'll get the best results with plastic erasers, such as the Richard Best "Tad" and the Eberhard Faber "Race Kleen." Moisten them for removing ink and stubborn typing; use them as they are for removing pencil lines. Large areas of ink can be removed completely without damage by using a moist cloth and Bon Ami cleanser. On Albanene, electric erasing machines are fine if used with a soft eraser.

### The Choice Is Up To You

When it comes to selecting K&E paper, cloth or film for the job at hand, we have to leave the choice to you. We're not being indecisive . . . it's just that you're the only one who knows the particular problem you have and which product solves it best. But remember . . . K&E has a *complete* line of paper, cloth and film . . . and only K&E puts a special "engineered surface" on all three media to provide a well-balanced, uniform surface suited to the base material.

**KEUFFEL & ESSER CO.,** Dept. CE-4, Hoboken, N. J.

Please send me more information and samples on the following:

☐ K&E Herculene ☐ K&E Albanene ☐ K&E Phoenix

Name & Title_____

Company & Address_____

_____ 1277

# NEWS BRIEFS . . .

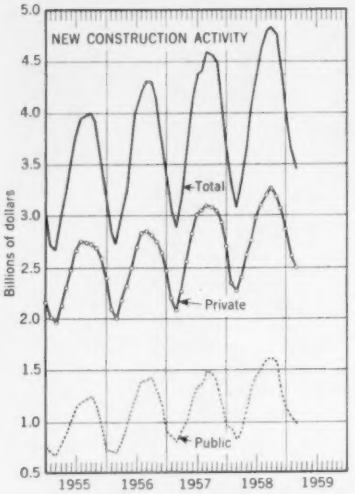
## Construction Activity Declines in February

February showed the usual seasonal decline in new construction activity. Even so the $3.5 billion total of work put in place was 12 percent above the previous February record set in 1958, according to preliminary joint estimates of the U.S. Departments of Commerce and Labor. Expenditures for the first two months of 1959 came to more than $7.1 billion—an all-time high for the January-February period.

Private spending for new construction in January and February was up 9 percent this year from 1958 to a record $5.1 billion, primarily the result of a 30 percent expansion in outlays for new dwelling units (to $2.2 billion). The increase in residential construction, coupled with strength shown by many other kinds of private work, more than offset the 35 percent drop from 1958 in expenditures for private industrial plant. Thus far in 1959 outlays for new industrial plants were at the lowest dollar level for any January-February period in eight years.

Public construction expenditures through the end of February 1959, at $2.0 billion, were 16 percent above the year-ago level and at a new high for the two-month period. The rise from 1958 was stimulated by increased activity on highways and housing, though most other types of public projects also scored advances.

Among the general indicators of future trends in activity are housing starts, contract awards, building permits, and materials output.




**Despite seasonal decline in February construction activity, the $3.5 billion of new work put in place was 12 percent above previous February record set last year.**

## AWWA Nominates New Officers

Lauren W. Grayson, M. ASCE, chief engineer and general manager of the Public Service Department of Glendale, Calif., has been nominated president of the American Water Works Association. The other nominees are C. F. Wertz, M. ASCE, director of the Miami Department of Water and Sewers, vice-president, and William J. Orchard, retired general manager of Wallace & Tiernan, Inc. of Belleville, N. J., treasurer. The nominations were made at the annual meeting of the association's Board of Directors held in New York recently.

**L. W. Grayson**

Harry E. Jordan, M. ASCE, will retire September 1 after serving nearly 23 years as secretary of the AWWA. Mr. Jordan, affectionately known as "Mr. Water Works," took over as the association's first full-time secretary in 1936, when the organization had only 3,000 members. Recently its membership went over the 12,000 mark. Raymond J. Faust, M. ASCE, since 1951 executive assistant secretary, will succeed Mr. Jordan as secretary in September.

If elected, the nominees will take office at the AWWA's 79th annual conference, to be held in San Francisco, July 12-17.

## Glen Canyon Highway Bridge Is Dedicated

Dedication ceremonies for the newly constructed 700-ft-high Glen Canyon highway bridge took place on February 20. Gov. Paul Fannin of Arizona and George D. Clyde, M. ASCE, governor of Utah, presided at the ribbon-cutting ceremonies, which opened the world's highest steel arch bridge for public use. Completion of the bridge by the joint-venture group, Kiewit-Judson-Pacific-Murphy, was scheduled for February 17. The structure is one of the initial installations in the U.S. Bureau of Reclamation's Glen Canyon development project.

Located at the Glen Canyon dam site, the $4,100,000 bridge connects new highways forming an alternate U.S. 89 route, which completes a north-south link between Utah and Arizona. Still to be completed are such projects as the building of about a mile of alternate cuts and fills on the bridge approaches and the installation of railings, lights, and other final detail work.

An article on the bridge appeared in the February issue of CIVIL ENGINEERING (page 50).

## Army Engineers Set Up New Offices in Alaska

Eight new resident offices are being established in Alaska by the U.S. Army Engineer District to supervise the government's multi-million-dollar defense and Civil Works program in the vast new state. The new centralized offices, which are being set up to provide the most efficient and economical method of field supervision, are Anchorage, Fairbanks, Juneau, Nome, Fort Greely, Clear, Shemya, and Western Alaska. Under this reorganization of District field forces, eight resident engineer and project engineer offices will be deactivated. Construction work, formerly handled by these offices, will now be under project engineers operating out of one of the eight centralized offices.

The Anchorage Resident Office, under Maj. Edwin R. Decker, will supervise construction at Fort Richardson and Elmendorf Air Force Base. The Fairbanks office, under Lt. Col. W. H. Mullin, will supervise construction at Ladd Air Force Base and Eielson Air Force Base. The Juneau office will supervise construction—principally of Civil Works projects—throughout Southeastern Alaska. Clifford C. Fenn is resident engineer. William Brown will be the resident engineer for the Nome office, which will be in charge of the Civil Works maintenance project for Nome Harbor.

The Fort Greely office, headed by Carl Eilertson, will supervise construction of Alaska's first nuclear power plant at the Army post there. Lt. Col. Joseph A. Bacci, A.M. ASCE, will be in charge of the Clear office, which will supervise work

at the Clear Air Force Station. Construction activities in the Aleutians will be under the Shemya office, which is headed by Maj. Alfred A. Victor, Jr. The Western Alaska office will have charge of all projects north and west of the Alaska Railroad except for the Nome and Aleutian work. Edward A. Smith is acting resident engineer.

## Huge Coliseum-Mart To Be Built in Atlanta

Mecca for Southern merchants will be the Southeastern Merchandise Mart and Coliseum, which will be started this spring on a 150-acre site in the northeastern suburbs of Atlanta, Ga. The site, at the junction of U. S. Highways 23 and 29 on the new arterial system, will be close to the De Kalb County Airport and only twenty-five minutes from downtown Atlanta. There will be parking facilities for 10,000 cars on the grounds of the development, and motel accommodations close at hand.

The eleven-story Mart building will have approximately 1,000,000 sq ft of office and showroom space. The adjoining Coliseum, with an area of 350,000 sq ft, will provide an unobstructed floor area equal in size to five football fields laid side by side. The vast single-story building will seat up to 25,000 and will accommodate trade shows with as many as 35,000 in attendance. Ground-breaking for the Coliseum is scheduled for mid-April, and completion by the end of the year.

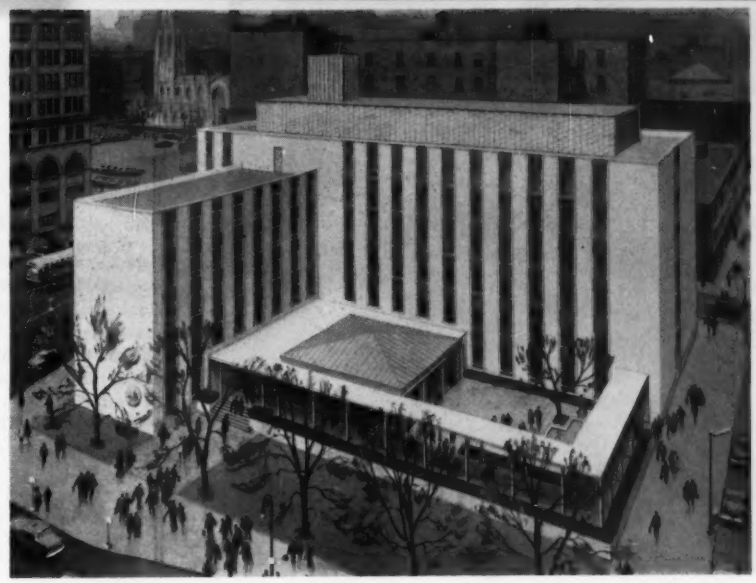
The cost of the joint enterprise is estimated at $20,000,000. Both the Mart and Coliseum will be under the management of the Southeastern Merchandise Mart, Inc., with headquarters at 680 West Peachtree, N. W., Atlanta 8, Ga.

## Los Angeles Approves Redevelopment Program

Los Angeles was given the green light for its proposed $315 million urban redevelopment program, with unanimous approval of the project by the City Council on February 9. The mammoth project, one of the largest and most spectacular redevelopment programs in the country, will transform the 136-acre semi-slum section in downtown Los Angeles, called Bunker Hill, into a modern improved area. (See article on the Bunker Hill project in January CIVIL ENGINEERING by W. H. Claire, M. ASCE, assistant executive director, Community Redevelopment Agency, City of Los Angeles.)

The redevelopment project includes a 24-acre residential plaza containing 3,100 modern apartment units, a 16-acre plaza for business structures, a six-acre hotel site, a four-acre shopping and office complex, and a 14-acre motel section. Parking for 20,000 cars will be provided on the perimeter of the site in multi-story, above-ground structures and in subsurface lots below each plaza. Since only about 10,000 cars will be required by those living and working in the area, the additional parking facilities provided will help solve the parking problem of the adjacent downtown business district and the city's new Civic Center.

Charles Luckman Associates, planning-architectural-engineering firm of Los Angeles and New York, is supervising architect for the project, and the Donald R. Warren Company, of Los Angeles, the consulting engineer.



### *New Engineering Building for Cooper Union*

**Work will start this spring on Cooper Union's new building for its free School of Engineering, shown here in architect's drawing. The $4,000,000 structure will permit housing under one roof for the first time all the departments in New York City's century-old, tuition-free engineering school. The building, of steel and concrete faced with brick and stone, will provide 100,000 sq ft of floor space. It will be erected immediately north of the original Cooper Union Foundation Building in the Astor Place area of Manhattan. Completion is expected in time for occupancy in September 1961. Voorhees, Walker, Smith, Smith and Haines are the architects, and Vermilya-Brown Company, Inc., the general contractor. Charles F. Peck, Jr., A.M. ASCE, head of Cooper Union's civil engineering department, worked on the structural design in cooperation with the architect.**

## January Steel Production Highest Since Mid-1957

Steel production is picking up. The January output of 9,312,000 tons was the highest for any month since June 1957, according to the American Iron and Steel Institute. This total represented an increase of 600,000 tons over the December 1958 output, and of 2.5 million tons over production in January 1958.

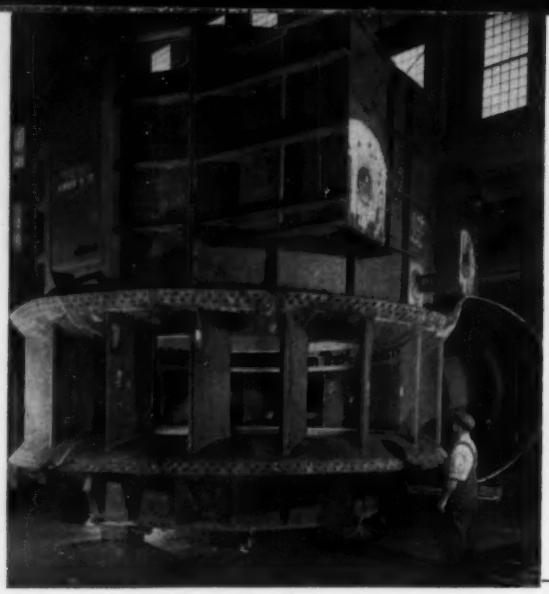
On the basis of the industry's rated capacity of 147,633,670 tons (as of January 1, 1959), the nation's steelmaking facilities were utilized at 74.3 percent of capacity in the past January.

## January Housing Starts Near Record for the Month

Although nonfarm housing starts declined 5 percent in January to 86,000 units, this total was 27 percent above the January 1958 figure and close to the record set for the month in 1955, according to preliminary estimates of the U. S. Labor Department's Bureau of Labor Statistics. The drop from December was all in privately owned units begun with Government-insured or guaranteed mortgages.

The volume of privately owned starts declined more than seasonally from the unusually high December figure to 83,300 in January. Seasonally adjusted, private starts were at an annual rate of 1,350,000 in January compared with 1,430,000 in December and an average rate of 1,354,000 units in the fourth quarter of 1958. The 83,300-unit total of private houses and apartments begun this January was 20,400 units above the January 1958 total. Over-the-year increases were shown in FHA- and VA-assisted starts, as well as in conventionally financed housing.

Starts in publicly owned projects totaled 2,700 in January 1959, compared with 1,500 in December and 5,000 in January a year ago. In recent months, most of the new public units were in federally aided low-rent projects.



## *Destination—Fort Peck Dam*

**Scheduled for early installation at Fort Peck Dam in northeastern Montana are two Allis-Chalmers Francis runner, plate steel scroll case hydraulic turbines. Shown here during shop assembly are the discharge ring, stay ring, and pit liner for one of these 63,500-hp, 170-ft-head hydraulic turbines. Assembly is 22 ft in diameter and 18 ft high. Previously installed at Fort Peck Dam (about 1951) are two 38,889-kva and one 16,667-kva Allis-Chalmers generators driven by S. Morgan Smith turbines.**

## Concrete Practices Reviewed at ACI Convention

The rapid increase in the use of precast concrete construction in the United States since the end of the war has led to considerable improvising and experimenting in both materials and methods of erection. A number of these improvisations and experiments were reviewed in technical sessions at the 55th annual convention of the American Concrete Institute, held in Los Angeles the last week in February. Also studied were the patterns now beginning to emerge in both methods and materials. It was pointed out that these patterns are indicative of the methods and materials that will ultimately be standardized.

Authors and their topics included J. L. Peterson, A.M. ASCE, president of J. L. Peterson, Inc., Long Beach, Calif., whose paper dealt with "Erection of Precast Concrete"; W. Howard Gerfen, A.M. ASCE, and John R. Anderson, consulting structural engineers of San Marino and Pasadena, Calif., who discussed "Joinery of Precast Elements"; Edward K. Rice, J.M. ASCE, and Felix Kulka, A.M. ASCE, of T. Y. Lin & Associates, Van Nuys, Calif., who authored a paper on "Design of Prestressed Concrete Lift Slabs for Deflection Control"; Henry M. Layne, M. ASCE, consulting structural engineer of Los Angeles, and T. Y. Lin, M. ASCE, of T. Y. Lin and Associates, Van Nuys, Calif., whose subject was "Prestressed Concrete Shells for Grandstand Roofs, Hipodromo Nacional, Caracas, Venezuela"; and Henry H. Edwards, president of Leap Concrete, Inc., Lakeland, Fla., who discussed "Precast and Prestressed Folded Plate Slabs."

Of much interest also was a session on special problems in concrete, especially the shielding requirements implicit in this atomic age. Properties of shielding concrete, with emphasis on fast neutron shields, were discussed by J. O. Henrie, of Atomics International, Canoga Park, Calif. R. A. Williamson, A.M. ASCE, of Holmes & Narver, Los Angeles, dealt with "Design and Performance of Special Purpose Blast-Resistant Structures," in a paper that described the blast and radiation effects of nuclear detonations on the concrete test structures that have been erected on Eniwetok and Bikini. A method for determining the influence of grade of reinforcing steel on blast resistance of beams, based on pre-selected criteria of failure, was the subject of a paper by Warren A. Shaw, A.M. ASCE, and J. R. Allgood, structural research engineers for the Navy's Civil Engineering Laboratory at Port Hueneme, Calif.

### New Standards Adopted

Three new standards of recommended practice for the concrete industry were adopted at the meeting. One describes a procedure for proportioning structural grade concrete containing lightweight aggregates by utilizing a "specific gravity factor." Another is a recommendation for hot weather concreting. This standard provides information useful in minimizing the detrimental effects of hot weather on concrete. The third recommendation is a revision of a former ACI Standard on measuring, mixing, and placing concrete "ACI 614-42." The proposed revision is concerned with a comparatively high standard of practice rather than common practices. All three proposals must go to the ACI membership for ratification by letter ballot before their adoption is official.

### 1959 Officers Elected

Phil M. Ferguson, M. ASCE, professor of civil engineering at the University of Texas, was named president of the Institute for a one-year term, succeeding Douglas McHenry, M. ASCE, director of development for the Portland Cement Association. Lewis H. Tuthill, concrete engineer in the Division of Design and Construction for the Bethlehem Steel Company, has been elected to a two-year term as vice-president. New directors, elected for a three-year term, are George C. Ernst and E. A. Finney, Members ASCE, Roger H. Corbetta, and Walter J. McCoy.

### Honorary Members Named

Election of three prominent engineers to honorary membership in the ACI was announced at the Awards Luncheon. They are the late Hardy Cross, Hon. M. ASCE, professor emeritus of civil engineering at Yale University; H. J. Gilkey, M. ASCE, professor of theoretical and applied mechanics at Iowa State College; and Edward Torroja, M. ASCE, director of the Instituto Tecnico de la Construccion, Madrid, Spain.

### Awards Presented

The Henry C. Turner Medal for "notable achievement in the execution and direction of research on concrete" was presented to Douglas E. Parsons, M. ASCE, chief of the Building Technology Division of the National Bureau of Standards. The Henry L. Kennedy Award was given posthumously to Joseph Di Stasio, M. ASCE, partner in the New York consulting firm of Di Stasio and Van Buren, for his "outstanding contributions to the advancement of the objectives of the American Concrete Institute."

The Wason Medal for Research went to Frederick T. Mavis, M. ASCE, dean of engineering at the University of Maryland, and M. J. Greaves, development engineer for Arthur G. McKee & Co., Cleveland. The Wason Medal for Most Meritorious Paper was awarded to John F. Brotchie for a paper on "General Method for Analysis of Flat Slabs and Plates." Mr. Brotchie is currently attending the University of California while on leave from the Melbourne (Australia) Department of Works. The Construction Practice Award went to Jack E. Rosenlund, structural engineer with George L. Dahl, architects and engineers of Dallas, for a paper on the Dallas Memorial Auditorium.

## Program to Stop Sinking Of Long Beach Harbor

Long Beach (Calif.) harbor officials have launched a crash program to stop the gradual subsidence of the harbor that has been plaguing Long Beach residents, businesses, oil operators, and the government for the past eighteen years. The $60 million program is under the direction of Sam Roberts, Subsidence Control and Repressurization Administrator for the Long Beach Harbor Program. M. A. Nishkian, head of the Long Beach consulting firm of M. A. Nishkian & Co., is the consulting engineer on the project.

Remedial plans call for flooding the rich shoreline oil field with sea water, which is expected to prevent further sinking of the area. Money will be spent on a system of 259 water wells and a network of miles of pipes leading through the 20-sq mile egg-shaped field. The 37 water wells currently in operation are producing 200,000 barrels of sea water a day from underground sources for injection into a test field. It is estimated that 1,000,000 barrels of water will be the daily requirement to stabilize the field and eliminate subsidence. The water is injected from 2,000 to 5,700 ft deep into layers of the ground from which oil has been removed. The program has the advantage of greatly increasing oil recovery as well as stopping subsidence.

The crash program is being pushed because of a recent government injunction demanding that the oil field be shut down. Since December 1936, when the first wells were sunk at Wilmington and Terminal Island, some 800 million barrels of oil have been pumped from the Long Beach area, the nation's second richest oil field. By 1941 the oil field was found to be sinking slightly. Subsidence is now at the rate of a foot a year at the center of the field. The Navy's $175 million shipyard lies in the heart of the subsidence area.

## Merger of Heating and Refrigerating Engineers

Merger of the American Society of Heating and Air-Conditioning Engineers with the American Society of Refrigerating Engineers has now been completed. The consolidated society will have a membership of over 18,000 and will be called the American Society of Heating, Refrigerating and Air Conditioning Engineers. It will have its headquarters in New York City and will join other engineering groups in the new United Engineering Center.

The new officers are Cecil Boling, president; Arthur J. Hess, Daniel D. Wile, Walter A. Grant, Robert H. Tull, and John Everetts, Jr., vice-presidents; John H. Fox and Franklyn Y. Carter, treasurers; and A. V. Hutchinson, executive secretary.

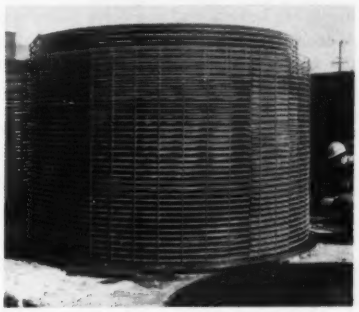
## Installing Pipe Under Railroad Tracks

Tunneling, narrow-gauge railway tracks, and on-the-job ingenuity have solved a problem for the Public Service Electric and Gas Company of New Jersey at its nearly completed Bergen Generating Station. The problem was to install 543 ft of cooling water discharge pipe under thirteen tracks of the New York Central and the New York, Susquehanna & Western railroads without interrupting traffic.

Two lines of 9-ft, inside diameter, reinforced concrete pipe were required to carry the fast-flowing discharge water from giant twin 290,000-kw steam turbine generator units. To provide the strength required to withstand both earth load and the vibration of passing trains, 9-in.-thick walls for the pipe were specified, reinforced with two cages of steel welded wire fabric.

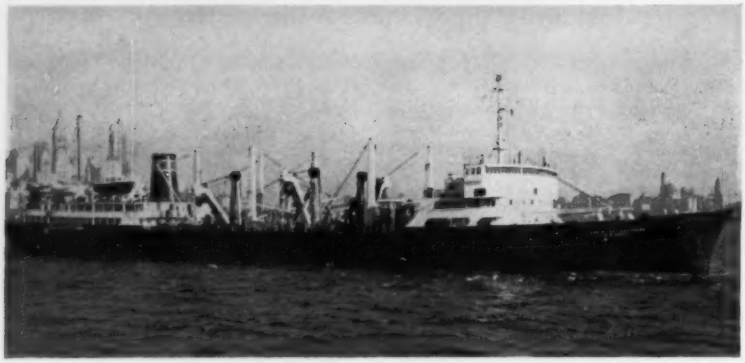
To get the twin pipelines under the right of way, it was decided to tunnel under the roadbed. With the tunnels cut through and lined with ¼-in. steel plate, stiffened every 16 in. with reinforcing rings, the pipe sections were then slipped into place inside the larger bore. To speed and ease the pipe-placing operation, narrow gauge railway tracks were laid the entire length of the tunnel, resting upon the bottom arc of the 12-ft-dia tunnel liner.

The Public Service Electric and Gas Company engaged J. Rich Steers, of New York, to drive the two tunnels under the supervision of the general contractor, United Engineers and Contractors, Inc., of Philadelphia. Motive power for pulling the sections into place came from an Ingersoll-Rand air "tugger."



**Workers check position of outer cage of welded wire fabric for concrete pipe section. Two sets of 0.505-in. circumferential wires, spaced 2 in. apart, make the heaviest known reinforcement ever used in 108-in. pipe.**

**Taut cable (foreground, between rails) slides pipe sections along rails, into place in tunnel under railroad right of way. Workers check bridle arrangement for pulling pipe section.**



## Giant Hydraulic Dredge Is Off for Work in Egypt

**The Corps of Engineers' hydraulic dredge, "Essayons," largest ship of its kind in the world, leaves New York Harbor for Egypt on a six-month lease to the Suez Canal Authority. Leasing charge is $240,000 per month. Before returning to the United States, the "Essayons" will remove some 11,000,000 cu yd of material from Port Said, the Bitter Lakes, and the Suez Canal area. The $11 million ship is queen of a fleet of fourteen seagoing hopper dredges operated by the Corps of Engineers to keep the nation's harbors and approach channels open for modern ocean shipping. Operating like a giant vacuum cleaner, the dredge has two 90-ft-long, 40-ton arms that are lowered from the sides of the ship. Through these arms two centrifugal pumps suck up 7,000 tons of material an hour as the vessel moves at a speed of 3 knots. The material is then deposited midship in hoppers with a combined capacity of 8,000 cu yd (equivalent to 12,000 tons of sand). Cruising speed of the "Essayons" is 15 knots.**

## Use of Wire Rope Speeds Pipeline Erection

**Extensive and adroit use of wire rope enabled contractors to erect a 12-in. pipeline for the Eastern Shore Natural Gas Co. over the busy Chesapeake & Delaware Canal without suspending waterway traffic for more than 24 hours. Complete installation required 13,648 ft of bridge strand and rope, fabricated at the Williamsport, Pa., plant of the Bethlehem Steel Co. The main strand supporting the 1,280-ft length of pipe was 1,304 ft long and 2 5/16 in. in dia. The pipe was attached to the main strand, on shore, by 63 suspenders of half-inch bridge rope. A general construction trolley cable, strung across the canal, carried the weight of the pipe and main supporting strand assembly as it was pulled across the waterway by a 1-in. cable connected to winches. The towers (147 and 181 ft tall) are 1,280 ft apart and engineered to maintain the pipe at 141 ft over the water. They were fabricated by the Trinity Steel Co., of Dallas, Tex. Clear Span Engineering Co., of Houston, Tex., designed and engineered the cable and tower assembly. The contractors were Midwestern Contractors, Inc., of Wheaton, Ill.**

## Grants for Urban Research

Grants have been awarded to the Highway Research Board's Committee on Urban Research by the Dodge Division of the Chrysler Corporation-ATA Foundation. The award, made in behalf of the American trucking industry and the Bureau of Public Roads, will be used for a "framework study" to guide the committee in its work. Specifically, the grant will advance the committee's objective of promoting a comprehensive nationwide program of urban research. The study will be headed by Prof. Coleman Woodbury, of the University of Wisconsin.

The Committee on Urban Research is a group of social scientists, engineers, businessmen, planners, and government officials, organized to step up the search for knowledge needed to cope with transportation and other problems of cities.

## AEC Licenses Firm to Dispose of Atomic Waste

The Atomic Energy Commission has announced its intention of licensing the Coastwise Marine Disposal Company, of Los Angeles, to dispose of radioactive waste material in the Pacific. Under the proposed license, the company will collect low-level waste material in containers from other AEC licensees. The waste will be packaged to assure safety in handling. The packages will have sufficient density to insure sinking to a depth of 6,000 ft. The disposal site contemplated is beyond the continental shelf about 130 miles southwest of Point Arguella, Calif., where the ocean is 12,000 ft deep.

## AEC Selects Contractor For Hallam Nuclear Plant

The Atomic Energy Commission has awarded a $9,000,000 contract to Peter Kiewit Sons' Company, of Omaha, Nebr., to act as general contractor on construction of the nuclear portion of the Hallam Nuclear Power Facility at Hallam, Nebr. The project—to be built under a cooperative arrangement between the Commission and the Consumers Public Power District of Nebraska—will include a sodium-cooled, graphite-moderated reactor. The power output of 75,000 kw will produce steam sufficient to supply a community of about 100,000.

The nuclear power plant will be operated by Consumers as part of its electrical generating system. Atomics International, a division of North American Aviation, Inc., of Los Angeles, is responsible for nuclear design and procurement of major reactor components. Architect-engineer for the nuclear plant is the Bechtel Corporation, of San Francisco.

Cost of the reactor portion of the plant is estimated at about $29,000,000, of which Consumers will provide $5,220,000. In addition, Consumers is furnishing the site and the turbo-generator portion of the power plant.

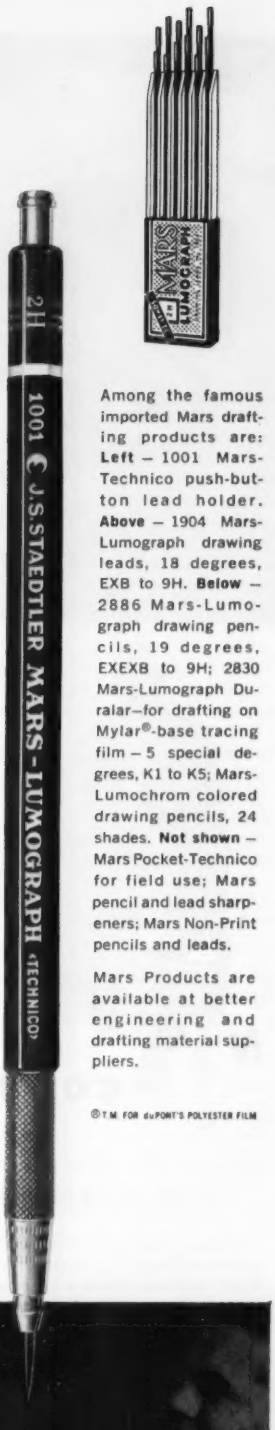
## *No. 15 • Mars Outstanding Design Series*

**NO COLUMNS!** In an unorthodox application of stress principles to multi-story construction, Architect Seymour Rutkin of New York has eliminated encumbering columns, achieved maximum space flexibility.

His office building of the future is supported by a concrete arch, and unified by circularly wrapped high tension steel cables which also hold the circular concrete floor slabs in compression. At areas of joining both floor slabs and arch are thickened and reinforced in generally three directions to resist moments and rotation about areas of arch support. Concrete is used in compression and steel in tension, as completely as possible. The cylinder in the center of the building is non-structural, acting as a mechanical core for elevators, plumbing, etc.

This ingenious departure from precedent is another example of the contribution today's designers are making. In translating their pace-setting ideas from concept to reality they require the best of drafting tools.

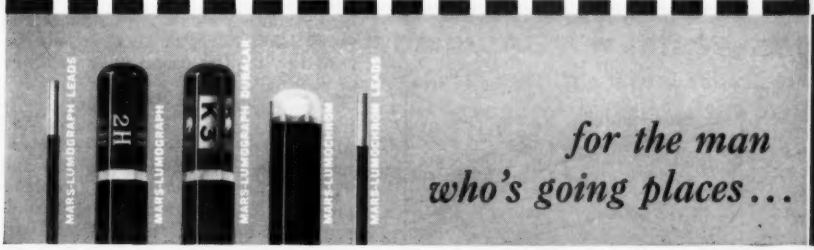
*In pencils that means MARS, long the standard of professionals.*




Among the famous imported Mars drafting products are: **Left** – 1001 Mars-Technico push-button lead holder. **Above** – 1904 Mars-Lumograph drawing leads, 18 degrees, EXB to 9H. **Below** – 2886 Mars-Lumograph drawing pencils, 19 degrees, EXEXB to 9H; 2830 Mars-Lumograph Duralar—for drafting on Mylar®-base tracing film – 5 special degrees, K1 to K5; Mars-Lumochrom colored drawing pencils, 24 shades. **Not shown** – Mars Pocket-Technico for field use; Mars pencil and lead sharpeners; Mars Non-Print pencils and leads.

Mars Products are available at better engineering and drafting material suppliers.

®T.M. FOR duPONT'S POLYESTER FILM




*for the man who's going places...*

*the pencil that's as good as it looks* **MARS**

**Sold at all good engineering and drawing material suppliers • J. S. STAEDTLER, INC. • Hackensack, N. J.**

## Taiwan Is Building

## Multi-Purpose Dam

**With a loan of $21,500,000 from the United States, Nationalist China is pushing plans for a multi-purpose hydroelectric and water-supply system that will reclaim 135,000 acres of land and supply 120,000 kw of electric power. Shihmen Dam, focal point of the project, will be a 508-ft-high arch dam, one of the highest in the East. Photo shows the 820-ft-long, 50-ft-dia tunnel, which is being built to divert Takekan Creek from the dam site. Tippetts-Abbett-McCarthy-Stratton, of New York, designed and are supervising construction of the project, which is being carried out by the Shihmen Development Commission. Morrison-Knudsen is the advisory constructor.**

---

# N. G. Neare's COLUMN

R. ROBINSON ROWE, M. ASCE

"Remember me?" asked Guest Professor Sauer Doe. "Let's hurry, then, because Noah wants to make a speech about the United Engineering Center as soon as Joe tells us Andy's profit on 700 melons."

"Well," began Joe Kerr, "if Andy bought $a$ Grade A melons at 3¢ and the rest at 2¢, his total cost was

$$C = 1400 + a \quad \ldots\ldots(1)$$

If he sold all by the $P$ Plan, $a$ at 5¢ and 700-$a$ at 3¢, he would receive

$$P = 2100 + 2a \quad \ldots\ldots(2)$$

while by the $Q$ Plan with $a$ at 7¢ and the others thrown in

$$Q = 7a \quad \ldots\ldots(3)$$

and by the $R$ Plan, all 700 at 4¢

$$R = 2800 \quad \ldots\ldots(4)$$

But if the customers choose the plans in proportions $p$, $q$, and $r$ where $p = 1\text{-}q\text{-}r$, Andy's profit is

$$x = (1\text{-}q\text{-}r)\,(2100 + 2a) + q.7a + r.2800 - (1400 + a)$$
$$= 700 + a - 2100q + 700r + 5aq - 2ar \quad \ldots\ldots(5)$$

Since you're in a hurry, you'd better let Cal finish up. From here on I went isiphuphuteki."

"As usual," scoffed Cal Klater. "Andy must choose $a$ so as to make $x$ a maximum while customers are choosing $q$ and $r$ to make it a minimum. A graph of Eqs (1) to (4) shows the influence of each of these options (Fig. 1). If $a$ is small, customers choose Plan $Q$ and Andy would lose unless $a > 233$; if $a$ is large, they would choose Plan $R$. But for $a = 400$, $Q = R$, marking the best Andy can do, a profit of $x = 1000$, or $10.00."

"Just so," agreed Professor Doe. "Obviously shrewd customers would never use the $P$ Plan. Knowing that $p = 0$ and $r = 1 = q$, Eq 5 can be reduced to

$$x = 1400 - a + 7q\ (a - 400) \quad \ldots.(6)$$
$$= 1400 - 2800q + a\ (7q - 1) \quad ..(7)$$

showing that Andy's profit is independent of $q$ when $a = 400$, and independent of $a$ when $q = \frac{1}{7}$."

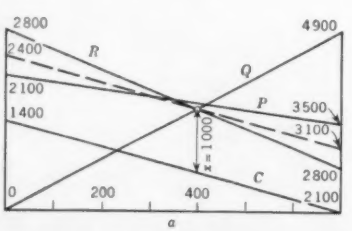



**Fig. 1. Andy stocks 400 good melons to gain $10.00, and customers (dashed line) choose Plans Q and R in ratio 1:6.**

"Geometrically," added Professor Neare, "the combination of any proportions of Plans $Q$ and $R$ can be represented by a line on Fig. 1 thru the intersection of Lines $Q$ and $R$. The line for $q = 1/7$ is the dashed line $a + 2400$ parallel to Line $C$. Thanks, Sauer, for a nice game of wits, and forgive me for rushing into my plug for the UEC Fund.

"We still needed $1,000 to make our quota when I solicited Titus Wadham and his staff this afternoon, but they were all ready to give me the old runaround. Titus, the tightwad, smirked as he subscribed for 1/8 of what all the others together might give. Irvin signed for 1/4 of what the others gave, and so on down the rank and file, with George giving 1/5, Henry 1/6, Titus Jr 1/7, Wilbur 1/15 and Art 1/18 of what the others gave. I'd have left empty-handed except that Dan, a new Junior hired this morning and not in on the gag, gave me his last buck and his last dime, exactly $1.10. Now how do you suppose we stand on our quota?"

[*Cal Klaters were S. K. Rueball (Keith Jones), Rudolph W. Meyer, John A. Tweed, David V. Messman, and Mrs. E. Nigma (Mrs. Robert E. Craig II). Guest Professor Sauer Doe is Marvin A. Larson. Also acknowledged are solutions of the January problem from William W. Mendenhall Jr. and Ed C. Holt Jr.*]

## Diablo Dam Discussed at Meeting of Presidents

Construction of the long-planned Diablo Dam, a $100 million Rio Grande project, may start soon as a result of the recent meeting of President Eisenhower and President Adolfo Mateos at Acapulco. The proposed multi-purpose dam would be located on the Rio Grande, just below its confluence with the Devil River and a few miles upstream from Del Rio, Tex. The earth and concrete structure, 6½ miles long and 253 ft high, would provide for irrigation and flood control. The dam would impound a 5.7-million acre-ft reservoir. Construction costs would be shared by the two countries on the basis of water allotment.

Diablo Dam was first planned in a treaty between the United States and Mexico made in 1944 to allocate the waters of the Rio Grande, Colorado, and Tijuana rivers. It was one of three dams proposed for the International Boundary part of the Rio Grande. Falcon Dam, the first of the three, has been in operation since 1953.

The International Boundary Commission, which was provided for in the 1944 treaty, will handle the design and construction of Diablo Dam.

Our community needs a new school.

We need it in a hurry.

We want a sturdy, attractive building.

We want fire safety for our children.

We want a building that's easy to add on to.

We want a flexible floor layout.

And we want to keep the cost low.

Now, what structural material do you recommend?

**How to give the community what it wants:** Recommend framing the school building with structural steel. Only steel framing meets all these demands. Both steel producers and steel fabricators have expanded facilities. There's an ample supply of the fabricated structural shapes you need — when you need them.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

**BETHLEHEM STEEL**

BETHLEHEM STEEL

# DECEASED

**Edwin Griggs Adams** (M. '05) age 88, one-time engineering associate of former President Herbert Hoover, died in upstate New York on March 4. He lived in Troy, N. Y. In 1897, at the request of the Chinese Imperial Government, Mr. Adams established and directed a civil engineering department at the Imperial University of Tientsin, where he remained until the Boxer Rebellion in 1900. Before returning to the United States in 1910, he directed surveying and construction in northern China as an engineering associate of Mr. Hoover. In 1917 Mr. Adams became president of Frederick deP. Hone, an engineering firm in New York City, holding that post until his retirement seventeen years ago. Mr. Adams graduated in 1891 from Rensselaer Polytechnic Institute.

**Louis Cullen Andrews** (A.M. '47), age 53, estimator for the Keller Construction Corporation, New Orleans, La., died there recently. Shortly after graduating from Stanford University in 1929, Mr. Andrews joined the Louisiana Department of Highways as an engineer in the Bridge Department in Baton Rouge. He was then superintendent and engineer in charge of concrete structures for the New Orleans City Park Commission. More recently he was chief engineer and estimator for the New Orleans firm, Dixie Machine Welding and Metal Works.

**Arthur Raymond Baylis** (M. '14), age 85, retired engineer for the Hudson and Manhattan Railroad, died recently in Peekskill, N. Y. Mr. Baylis was with the H. & M. R. R. from 1921 until his retirement, serving as an assistant engineer and engineer of design.

**Kurt Bernhard** (M. '50), age 60, died in New York City on January 27. For the past few years Mr. Bernhard was structural engineer for the New York firm of Ammann & Whitney. A naturalized citizen of the U. S., he was educated abroad, receiving his doctor of engineering degree in 1922 from the Technische Hochschule in Berlin. For many years Mr. Bernhard was a consultant to the Turkish Ministry of Public Works in Ankara on the design and supervision of $180,000,000 worth of projects, including the university, hospital, and the Turkish Parliament Building. One of his handbooks dealing with the design of earthquake-proof buildings was published by the Turkish government.

**Walter P. Bloecher** (A.M. '23), age 69 retired engineer and specialist in engineering-economics, of Philadelphia, Pa., died recently. One of his important assignments was as engineer in charge of budget and engineering-economic reports to owners and bankers for the Stone & Webster Engineering Corporation during the construction of the $55,000,000 Conowingo Hydroelectric Project on the Susquehanna River. He was similarly employed on the $19,000,000 improvement program of the Philadelphia & Reading Coal & Iron Company, and from 1932 until his retirement in 1955 was assistant to the president of the company. Mr. Bloecher was graduated in 1914 from the University of Wisconsin, with B.S. and C.E. degrees.

**Edwin L. Bruner** (M. '32), age 70, retired architect and structural engineer of South Pasadena, Calif., died there on January 28. As a member of the Los Angeles firm of Grant & Bruner, Ltd., for thirty-one years, Mr. Bruner was responsible for the design of numerous industrial plants in Southern California. From 1954 until his retirement in 1957, Mr. Bruner was in private practice. He was a graduate of the University of Southern California.

**Robinson D. Buck** (M. '51), age 50, partner of Buck and Buck, with offices in West Hartford, Conn., died recently. Mr. Buck became a partner in the firm in 1939. Earlier he had been assistant engineer with the City Engineers Office in Hartford, Conn., and chief engineer with Henry Wolcott Buck. Mr. Buck received a B.S. degree from Yale University.

**Alfred Carleton Clarke** (M. '31), age 71, of Vero Beach, Fla., died there recently. Mr. Clarke retired as chief engineer of the Baltimore and Ohio Railroad in 1953, after thirty-eight years of service. Before receiving his B.S. in civil engineering from Purdue University in 1915, Mr. Clarke worked as an inspector on bridge construction for the Saskatchewan Department of Highways and Bridges in Canada.

**Frank J. Collins** (A.M. '09), age 82, vice president and chairman of the board of the Dale Engineering Company in Utica, N. Y., died recently. Connected with the company for forty-five years, Mr. Collins served as its president for thirty-nine of those years. He received his civil engineering degree from the University of Pennsylvania.

**Roy G. Finch** (M. '22), age 75, consulting engineer of Albany, N. Y., died there on March 4. Mr. Finch was the last person to hold the title of state engineer before it was changed to superintendent of public works about thirty years ago. Previously he had been in private practice and with the State Engineering Department.

**Eric Fleming** (M. '32), age 62, noted architect and structural designer with the Public Service Electric and Gas Company of Newark, N. J., died on March 1 in New Brunswick. In the mid-1920's he was in charge of designing the ventilation system for the Holland Tunnel. Earlier he was assistant to the design engineer of the Port of New York Authority in the construction of Inland Terminal No. 1. He was supervisor of three hundred designers on the "Highways and Horizons" Futurama model of the General Motors Exhibit at the 1939-1940 New York World's Fair. Mr. Fleming, an amateur magician, was accidentally killed while attempting an escape trick.

**Everett B. Flinn** (M. '42), age 67, airport engineer for the Civil Aeronautics Administration in Lincoln, Nebr., died on January 30. Mr. Flinn joined the CAA as an assistant airways engineer in 1944. Earlier he had been project engineer for the Missouri State Highway Commission in 1925; and county engineer for Knox County, Mo. in 1935; and WPA administrator for the St. Louis, Mo., area in the early 1940's. He was a civil engineer graduate of Massachusetts Institute of Technology in 1912.

**Lloyd George** (A.M. '54), age 40, partner in the Spokane, Wash., firm, Henry George and Sons, died there recently. The firm, which specializes in the design and construction of reinforced concrete grain elevators, has designed and built fifty of these plants since 1945, the year Mr. George became a member. After graduating from the University of Washington with a B.S. in civil engineering in 1943, he joined the Boeing Airplane Company as a junior engineer.

**Edwin M. Grime** (M. '40), age 82, consulting engineer of St. Paul, Minn., died there on February 7. Mr. Grime, who retired as an employee of the Northern Pacific Railway in 1946, started his railroad career with the Chicago Great Western. Subsequently he became supervisor of bridges and buildings for the Northern Pacific at Billings, Mont. He went to St. Paul in 1925 as Northern Pacific engineer of water resources.

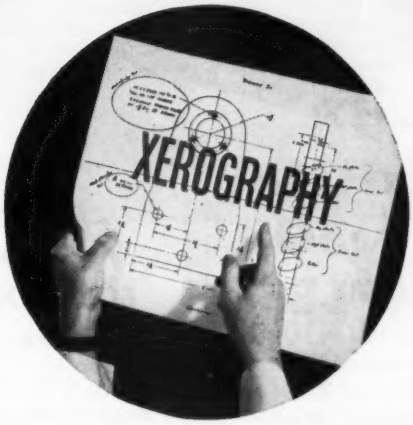
**Ernest Edmund Grimes** (A.M. '13), age 74, consulting engineer of Ogden, Utah died recently. Mr. Grimes had been in private practice since 1922 when he opened offices in Chicago, Ill. Earlier he was chief engineer for the Knight Investment Company in Provo, Utah; division engineer for the Oregon Shortline Railway Company in eastern Oregon; and engineering assistant to the general superintendent for T. L. Huston, contracting engineers of Havana, Cuba. Mr. Grimes was educated at the State University of Kentucky.

**Frank Harley** (A.M. '43), age 66, consulting engineer for F. E. Harley & Associates in Wychoff, N. J., died in Mahwah on February 19. At the time of his death Mr. Harley was the engineer for Franklin Lakes, Saddle River and consultant for Morris County. He had been a civil engineer for forty years and at one time was the engineer for seventeen townships and boroughs in Bergen County. Mr. Harley received his B.S. in 1921 and his C.E. in 1928 from Cooper Union.

**Fred L. Hicks** (A.M. '40), age 59, senior draftsman for the Georgia State High-

*(Continued on page 114)*

Use any reproduction process . . .




## Your drawings reproduce sharper, clearer with Eagle Turquoise

**TURQUOISE LEAD HOLDERS** hold any TURQUOISE lead (5B to 9H).

**TURQUOISE DRAWING PENCILS** are made in 17 degrees, 6B to 9H.

**TURQUOISE WITH ERASER,** in grades 4B to 6H, is increasingly popular as a field tool.

Whatever the process, you'll get sharper, clearer prints if you use an Eagle TURQUOISE. Lines are more opaque and also blacker—because the graphite in TURQUOISE is finer-ground with denser-packed particles.

Get smoother, neater drafting, too! TURQUOISE glides effortlessly, evenly over paper, cloth, vellum, "Mylar"®. And uniform grading means consistent peak performance.

So, no matter what you draw on, how you reproduce it, use Eagle TURQUOISE for superior results every time!

EAGLE®

**FREE SAMPLE!** Prove for yourself that Eagle TURQUOISE draws smoother, reproduces sharper. Write, specifying degree of lead, pencil or pencil with eraser to: Eagle Pencil Company, Danbury, Conn.

## Deceased

*(Continued from page 112)*

way Department at Atlanta, died recently. A senior draftsman since 1956, he had been employed by the Georgia Highway Department for nearly twenty years. From 1923 to 1940 Mr. Hicks was draftsman with the Missouri State Road Department.

**Leslie G. Holleran** (M. '22), age 77, prominent consulting and design engineer of New York City and former Director of ASCE (1931-1933), died in Bronxville on February 6. As a partner in the New York firm of Clarke, Rapuano and Holleran from 1944 to 1951 he worked on the design of some of the major expressways in the New York City area. After retiring from the firm in 1951, he became a consultant to its successor firms. In his early career he served as assistant engineer on construction of the Catskill Aqueduct for the City of New York, and later, as consultant to the Metropolitan Life Insurance Company on design and construction of Parkchester and the design of Stuyvesant Town, Peter Cooper Village and Riverton housing projects. As deputy chief engineer of the Westchester County Park Commission, he was awarded a silver medal by the New York Society of Arts and Sciences in recognition of work on the Bronx River Parkway. Mr. Holleran graduated in 1906 from Union College. He had been president of the Metropolitan Section.

L. G. Holleran

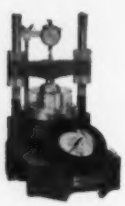
**George G. Honness** (M. '12), age 87, a retired civil engineer of Philadelphia, Pa., died there on February 14. Mr. Honness was graduated from Lafayette College in 1893, and spent most of his professional life on the New York City water supply. After completion of the work on the Catskill Aqueduct, he became department engineer in charge of Ashokan dam and reservoir and construction of the Gilboa Dam and the 18.1-mile Shandaken tunnel, longest in the world at the time of completion. Mr. Honness was department engineer on the preliminary investigation of the Delaware River water supply and was responsible for locating the dam sites and the aqueduct for this addition to New York's water supply, now nearing completion. He retired in 1931.

**Merton E. James** (A.M. '10), age 78, retired civil engineer of Gulfport, Miss., died there recently. After thirty years on engineering projects, for some eighteen years with the State of New York, Mr. James joined TVA in 1935. He was materials engineer on the construction of Pickwick, Wheeler, Chickamauga, Watts Bar, and Fort Loudoun Dams. He left TVA in 1943 to do engineering work at Oak Ridge. In his early career he was with the Dixie Construction Company, which handled the construction of hydroelectric developments and steam plants for a group of Southern hydroelectric producing companies. He graduated from Rensselaer Polytechnic Institute in 1904.

**Charles W. Kunkle** (M. '30), age 72, vice president and general manager of the Johnstown Water Company and the Manufacturers Water Company, Johnstown, Pa., died recently. Mr. Kunkle joined the Johnstown Water Company as resident engineer in 1918. He became superintendent in 1922, and vice president and general manager in 1928. About fifteen years ago he assumed the vice presidency and general managership of the Manufacturers Water Company. Mr. Kunkle received his B.S. in 1910 from Pennsylvania State College.

**James W. Lasher** (J.M. '49), age 33, sales engineer for the Armco Drainage and Metal Products, Inc., at Minneapolis, Minn., died in Duluth on January 12. His first job after graduating in 1949

*(Continued on page 116)*

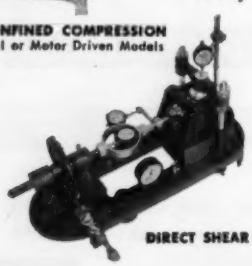
CONBEL
Consolidation Tester
Capacities to 10,000 lbs.

# TESTING SOIL SAMPLES?

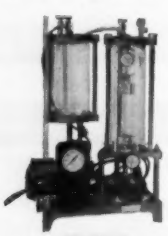
. . . take a closer look at the Tinius Olsen line of K-W Physical Soil Testing Machines. These rugged, portable units are designed for convenient "table top" operation in the lab or on the job site.

Get the full story. Write today for Bulletin 50-A.

UNCONFINED COMPRESSION
Manual or Motor Driven Models



DIRECT SHEAR



TRIAXIAL
Capacities to 3,000 lbs.

TINIUS OLSEN
Testing Machine Co.
2170 Easton Rd. • Willow Grove, Pa.

## PAPERS FROM THE CONFERENCE ON ELECTRONIC COMPUTATION

The twenty five papers presented at the Conference on Electronic Computation, exactly as delivered at the Conference, are being offered in a single paper-bound volume.

| | *Members* | *Non-members* |
|---|---|---|
| First Copy . . . . . | $ 5.00 | $10.00 |
| Additional Copies . . | $10.00 | $10.00 |

*If you wish to receive a copy of this publication, please use the accompanying order form.*

---------- CUT HERE ----------

**American Society of Civil Engineers**
**33 West 39th Street, New York 18, N. Y.**

Please send.....copy(s) of the Conference on Electronic Computation Papers.

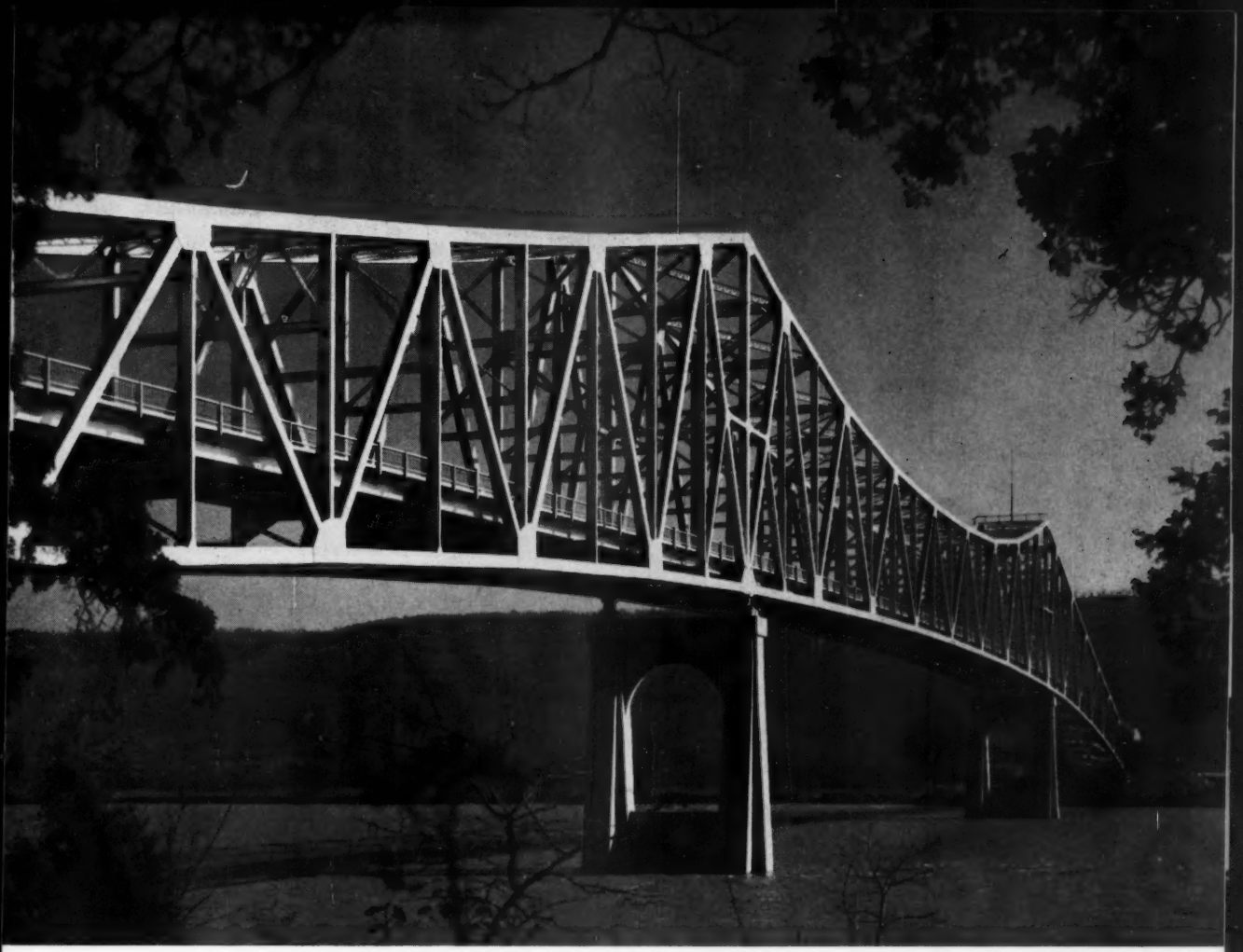
(I am).....(I am not).....a member of ASCE.
The amount enclosed is $.....

---

NAME .....
*Print Name*

STREET .....

CITY .....ZONE.....STATE.....
. . . OF C.P.



# 2,090 tons of structural steelwork erected in 3 months

The new Tennessee River Bridge near Stevenson, in Jackson County, Alabama, points up some of the exclusive advantages of steel in bridge construction—advantages which become all the more obvious when your project involves a difficult water crossing and material handling problems.

Replacing an old ferry, this 1,400′ long, two-lane, 26′ roadway bridge has 3 continuous through truss spans. The 375′ side spans were constructed atop steel falsework mounted on barges anchored on the river bank, and simply floated into position on piers. The 500′ main span was then constructed from the piers. Trusses are 72′ deep at the main piers and 40′ deep at center of the main span. Vertical clearance above normal water level at center of main span is about 60′.

Thanks to precision fabrication and ease of handling, 2,090 tons of structural steelwork for this handsome bridge was erected and connected in only three months. And traffic rolled in only four months.

American Bridge has the facilities, experience and personnel to handle any type of structural steel job. We invite your inquiries.

**Tennessee River Bridge** *(near Stevenson, Alabama)*

Owner: Alabama State Highway Department
Designs:
Substructure and approaches by
Trotter-Ernest Engineering Company, Mobile, Ala.
Superstructure by Donald C. A. duPlantier, Nashville, Tenn.
Fabricated and Erected by American Bridge Division, USS
Substructure by Harbert Construction Corporation, Birmingham, Ala.

**American Bridge Division of USS United States Steel**

General Offices: 525 William Penn Place, Pittsburgh, Pa. Contracting Offices in: Ambridge · Atlanta · Baltimore · Birmingham · Boston · Chicago · Cincinnati · Cleveland Dallas · Denver · Detroit · Elmira · Gary · Harrisburg, Pa. · Houston · Los Angeles · Memphis · Minneapolis · New York · Orange, Texas · Philadelphia · Pittsburgh Portland, Ore. · Roanoke · St. Louis · San Francisco · Trenton · United States Steel Export Company, New York

## Deceased

*(Continued from page 114)*

from the University of Pittsburgh, was with Babcock and Wilcox at Barberton, Ohio. In 1950 he was associated with the Pennsylvania State Highway Department, and from 1952 to 1956 was assistant division engineer for the Baltimore and Ohio Railway.

**Howard A. Levering** (M. '27), age 71, retired construction engineer for the West Virginia State Road Commission, died in Ceredo, W. Va., on January 1. He received the degree of Engineer of Mines from Ohio State University in June, 1910, and worked as mining engineer, first with the Island Creek Coal Company at Holden and later with the New River and Pocahontas Consolidated Coal Company at Berwind. In 1918 he went to Wayne County, W. Va., as its first county engineer, and held that position until 1922 when he became associated with the West Virginia Road Commission. He was retired in 1954.

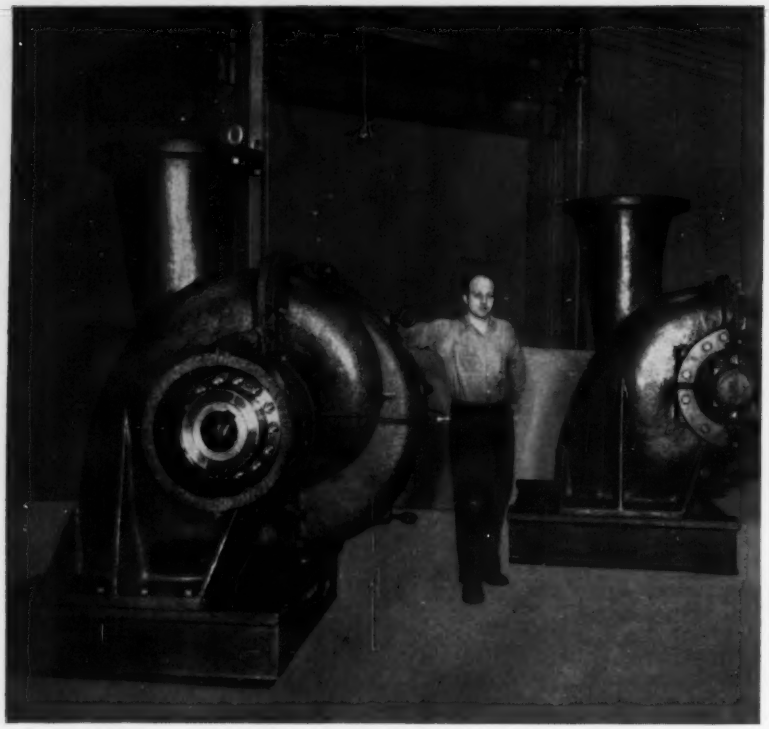
**Newton F. McCoy** (M. '44), age 66, planning officer for the Idaho State Highway Department at Boise, died there recently. For some twenty years prior to his appointment to the Idaho State Highway Department in 1956, he was resident engineer and principal highway engineer for the U. S. Bureau of Reclamation in charge of its Western District. Mr. McCoy attended Reed College in Portland, Ore.

**Frank A. Nikirk** (M. '40), age 78, professor of civil engineering on the Berkeley campus of the University of California, died there recently. Professor Nikirk started his career in 1909 as assistant city engineer of San Jose, Calif., remaining there until 1912. For several years thereafter he was in private practice. He had been consultant to the Corps of Engineers and on the engineering staff of the Milton-Hale Machinery Company, at Albany, N. Y., the Thew Shovel Company, at Lorain, Ohio, and other equipment-manufacturing concerns. He had been at the University of California since 1951. Professor Nikirk received his B.S.C.E. from Stanford University in 1904.

**Frederick Josiah Spry** (A.M. '24), age 71, professor emeritus of civil engineering at Cornell University, Ithaca, N. Y., died there recently. After graduating from Lafayette University with a B.C.E. in 1914, he worked for several years as a maintenance engineer for the Lehigh Valley Railroad at Easton and Sayre, Pa., and in Auburn, N. Y. In 1923 he joined the civil engineering staff at Cornell as an instructor, retiring as professor emeritus in 1956. He received his master's in civil engineering from Cornell in 1929.

**W. A. Stinchcomb** (M. '14), age 80, director-secretary of the Cleveland (Ohio) Metropolitan Park Board for thirty-six years before retiring a year and a half ago, died in Cleveland on January 18. Instrumental in obtaining legislation setting up the Cleveland Metropolitan Park Board and its first director, Mr. Stinchcomb will be remembered as the man who fashioned Cleveland's priceless "emerald necklace of parks." In appreciation Greater Cleveland citizens have contributed to erect a monument hailing him as an engineer, conservationist, and public servant. Parallel with his public service work, Mr. Stinchcomb was president of the W. A. Stinchcomb Company, 1915-1932; treasurer of the U. S. Engineering & Construction Company, 1918-1928; vice president of the Broadview Savings & Loan Association, 1925-1941; and in 1939 a director of the Cleveland Railway Company.

**Robert P. White** (M. '47), age 61, supervising chief engineer of the Eastern Office, Division of Design and Construction of the U. S. National Park Service died recently in Philadelphia, Pa. With the exception of the war years, 1943-1945, Mr. White had served with the National Park Service continuously since 1931. In 1920 he graduated from West Virginia University with a B.S. in civil engineering.

***the bigger your pumping problems...the better your reasons for giving them to WHEELER-ECONOMY***

At the Owyhee Irrigation Project, Homedale, Idaho, the problem was four high-capacity pumps which would move water from the Snake River to an irrigation canal 180 feet above. C.H. Wheeler solved it with the 30" x 24" Double-Suction Pumps shown here, each rated at 19,000 gpm, and two 36" x 24" Double-Suction Pumps rated at 19,700 gpm.

With nearly three-quarters of a century of pump design and manufacturing experience, C.H. Wheeler is well qualified to solve pump problems of any size and any degree of complexity. Applications include flood control, irrigation, drainage, water supply and condenser circulation. Capacities of Wheeler-Economy Pumps range from 50 to more than 220,000 gpm.

See your Wheeler-Economy representative or write direct for information on centrifugal, axial or mixed flow pumps custom made for any high-capacity need.

*Economy Pump Division*

**C.H. WHEELER MFG. CO.**

*19th and Lehigh Avenue • Philadelphia 32, Pa.*

*Whenever you see the name C.H. Wheeler on a product, you know it's a quality product*

Centrifugal, Axial and Mixed Flow Pumps • Steam Condensers • Steam Jet Vacuum Equipment • Marine Auxiliary Machinery • Nuclear Products

# BIRD'S EYE VIEW OF RESPONSIBILITY

Driving pile foundations is just one aspect of Raymond's *single responsibility*. Of all the foundation organizations in the country only Raymond offers—and is solely responsible for—complete foundation service including soil investigation, pile manufacture, load testing and installation. When you specify Raymond foundations you receive the benefit and economy of having all the details handled expertly and efficiently by one company. On your next project, no matter how large or small it may be, employ Raymond's more than 300,000,000 man-hours of experience in providing all types of foundations. Get all the facts from the Raymond office nearest you, or write our main offices, 140 Cedar Street, New York 6, New York.

RAYMOND
CONCRETE PILE COMPANY

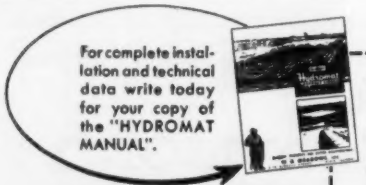
*A Division of Raymond International, Inc.*
**140 CEDAR STREET, NEW YORK 6, N. Y.**
*Branch offices in principal cities of the United States. Subsidiaries in Canada, Central and South America and other countries around the world.*

**FOUNDATIONS FOR THE STRUCTURES OF AMERICA . . . COMPLETE CONSTRUCTION SERVICES ABROAD**

**NOW... provide *COMPLETE* containment of water, wastes, brines and sludges with**

SEALTIGHT **Hydromat**
**ASPHALT LINERS**

Pre-fabricated "HYDROMAT" Asphalt Liners provide the ideal liner for all domestic, industrial and recreational facilities where the containment of water, wastes, sludges, brines, etc. demand a very efficient, economical and impervious lining material. "HYDROMAT" is quickly and easily installed as a monolithic liner with mechanically sealed joints . . . will expand and contract with soil movements without rupturing or breaking the seal. Installed over (exposed) or under earth, concrete, gunite, steel or other materials . . . provides the practical answer to the problem of re-lining old, cracked concrete or gunite linings. "HYDROMAT" may be safely used for the containment of potable water in clear well construction and its ruggedness and durability permit its use as a fully exposed lining in large reservoirs to depths exceeding 50 feet. "HYDROMAT" is available in three thicknesses, ½", ¼" and 5/32", in 4' widths and lengths up to 15' . . . longer lengths available on special request.




SEALTIGHT PRODUCTS FOR BETTER CONSTRUCTION

**W. R. MEADOWS, INC.**

20 KIMBALL STREET
ELGIN, ILLINOIS

W. R. Meadows, Inc.
20 Kimball Street, Elgin, Illinois

Gentlemen.

☐ Send my copy of the "HYDROMAT MANUAL".

☐ Have representative call.

NAME _____ TITLE _____

FIRM _____

ADDRESS _____

CITY _____ STATE _____

## News of Engineers

*(Continued from page 27)*

**Ervin Greenbaum,** Colonel, Corps of Engineers, and commandant of the Detroit U. S. Army Reserve School at Fort Wayne, Mich., has been elected president of Northern Machinery Industries, Inc., Michigan. Colonel Greenbaum is in Rio de Janeiro to complete plans for expansion of facilities now under construction.

**Merritt A. Neale,** former assistant director and chief engineer of the Public Parking Authority of Pittsburgh, Pa., is the new executive director of the Authority. He succeeds **William R. B. Froehlich,** who served as executive director for seven years before his recent appointment as chief deputy secretary of highways for Pennsylvania.

**James B. Diven, Jr.,** has been named to the newly created position of standards coordinator for Ethyl Corporation, Baton Rouge, La. In this capacity he will be responsible for the development of engineering standards and specifications for company-wide application. Mr. Diven was project engineer for the corporation prior to his promotion.

**Albert C. Allen,** regional engineer of the Housing and Home Finance Agency at Fort Worth, Tex., retired in February after twenty-six years of continuous government service. He began his career with the government as state airport engineer for the Bureau of Air Commerce, now the Federal Aviation Agency. Mr. Allen joined the HHFA in 1950.

**Russell E. Barnard** recently retired as advisory engineer of Armco Drainage and Metal Products, Inc., Middletown, Ohio, after thirty-eight years service. Mr. Barnard's principal fields of activity were the design and use of steel pipe for water service and for foundation piles.

**William P. Jones, Jr.,** Colonel, Corps of Engineers and district engineer at Memphis, Tenn., has been selected to attend the Army War College at Carlisle Barracks, Pa. Colonel Jones, who has been at Memphis since 1957, will remain at his post until August.

**Milton P. Barschdorf,** Colonel, Corps of Engineers, and Vicksburg district engineer, will assume new duties in the Far East in July. Colonel Barschdorf, who served as secretary of the Mississippi River Commission and assistant division engineer of the Lower Mississippi Valley Division for a year, has been district engineer at Vicksburg since 1956.

**Albert F. Reichmann,** of Glencoe, Ill., oldest living past president of the Western Society of Engineers, received special tribute from the Society at its February 24th dinner meeting in Chicago. Mr. Reichmann retired in 1938 as vice president of the American Bridge Division of the U. S. Steel Corporation.

# Selected to span the Schuylkill

## Fabricated Structural Steel by INGALLS*

A new bridge to support the endless lines of heavy traffic over the Schuylkill River is now being constructed of huge steel girders fabricated by INGALLS.

These giant girders, weighing up to 144 tons each, extend 243 feet to a section with a depth at the haunch of 15 feet. A unique system of four cranes is being used to lift the huge structures into place.

Kaufman Construction Company, the bridge contractor, is using about 4000 tons of INGALLS continuous girders, cross girders, stringers and other fabricated structural steel.

Strength, precision and economy are hallmarks of INGALLS fabricated steel. Call or write for estimates on your next job.

*Contractors:* Kaufman Construction Company

*Consulting Engineers:* Gannett, Fleming, Corddry & Carpenter

*Fabricated Structural Steel:* The Ingalls Iron Works Company

*Steel Erection:* Cornell & Company

*One of many Ingalls fabricated steel girders supporting Upper University Avenue Bridge on Philadelphia's Schuylkill Expressway.

THE INGALLS IRON WORKS COMPANY
Executive Offices
BIRMINGHAM, ALABAMA

**INGALLS INDUSTRIES ARE:** **The Ingalls Iron Works Company,** Sales Offices: New York, Pittsburgh, Chicago, Houston, New Orleans, Atlanta • **The Ingalls Steel Construction Company,** Sales Offices: New York, Chicago, New Orleans, Pittsburgh, Houston, Atlanta • **Birmingham Tank Company,** Sales Offices: New York, Pittsburgh, Chicago, Atlanta, New Orleans, Pascagoula • **The Ingalls Shipbuilding Corporation,** Shipyards: Pascagoula, Mississippi; Decatur, Alabama
Sales Offices: New York, Chicago, Washington, Houston, New Orleans, Atlanta

# LOWER COSTS OF UNDERPASS PIERS

Northwest Expressway Underpass, Milwaukee, Wisconsin
Contractor—Speedway Contracting Co.
Designer—Wisconsin Highway Dept.
Engineer—DeLeuw-Cather & Company

*Form round concrete columns faster, more economically with easy-to-handle*

**SONOCO**
***Sonotube.***
**FIBRE FORMS**

When there's a round column of concrete to be formed, use a low-cost SONOTUBE Fibre Form to do the job . . . it's far faster and more economical than by any other method!

In the project illustrated, "A" Coated Sonotube Fibre Forms of 44" I.D. in 15'9" and 18'3" lengths were used to form the concrete columns required for the bents.

These low-cost fibre forms save time, money and labor because they are easy to handle and place, strip quicker, and require only minimum bracing.

Choose from 3 types: Seamless (premium form for finished columns), "A" Coated (standard form for exposed columns), or "W" Coated (for unexposed columns).

Sonoco SONOTUBE Fibre Forms are available in sizes from 2" to 48" I.D. Order in specified lengths or standard 18' shipping lengths. Can be sawed to size on the job.

*See our catalog in Sweet's*
*For information and prices, write*

- HARTSVILLE, S. C.
- LA PUENTE, CALIF.
- MONTCLAIR, N. J.
- AKRON, INDIANA
- LONGVIEW, TEXAS
- ATLANTA, GA.
- BRANTFORD, ONT.
- MEXICO, D.F.

3584

**SONOCO**
**Construction Products**
**SONOCO PRODUCTS COMPANY**


## New in Education

**For better use of our scientific knowledge . . .** One of twenty conferences, called at the special request of President Eisenhower to promote more effective use of our scientists and engineers, will be held on Friday and Saturday, April 24-25, at the *University of Kansas City*, Kansas City, Mo. The conference is designed to attract executives and supervisors of organizations employing scientific personnel, as well as the scientists and engineers themselves. The program will stress the Midwest area, and its particular problems for utilizing its scientific training and talent. Dr. William Torpey, of the Executive Office of the President, is the adviser for the conference. Honorary co-chairmen are Dr. Richard M. Drake, Chancellor, the University of Kansas City and N. T. Veatch, M. ASCE of Black and Veatch. Co-chairmen are Dr. Robert T. Howard, chairman, Department of General Engineering, University of Kansas City, and Melford E. Monsees, chief, Program Development Branch, Kansas City Engineer District.

**Building for research . . .** A grant of $1,250,000 from the Boettcher Foundation has been made to the *University of Denver* for construction of a Science-Engineering-Research Center. The objective of the Boettcher Center for Science will be to integrate teaching and basic research in the physical sciences and in the applied fields of engineering.

**Assistantships open . . .** The *State College of Washington* announces that research assistantships in all phases of sanitary engineering are available for the 1959-1960. Graduate programs leading to degrees of Master of Science in Hydraulic Engineering and Master of Science in Civil Engineering are also offered, for which research and teaching assistantships are available on a nine-month basis. For further information write to Prof. Emmet B. Moore, Chairman, Department of Civil Engineering, State College of Washington, Pullman, Wash.

**Testing machines . . .** Two large testing machines valued at $150,000 have been installed in the *Oklahoma State University* civil engineering materials testing lab. They will be used on research projects calling for fatigue tests of concrete and metals. Unlike many fatigue testers, these machines can either stretch or compress test samples. Prof. Roger L. Flanders will supervise testing operations.

**Improved pump . . .** *Lehigh University's* Institute of Research has received a research contract for $29,700 from the Army Corps of Engineers Philadelphia Engineer District to improve design of a hopper dredge pump. A scale model will be constructed and experimental tests run with various concentrations of silt-bearing water. Professor John B. Herbich, A.M. ASCE, chairman of the hydraulics division, is the project director. He will be assisted by Roger C. Ditting, assistant professor of civil engineering, and Philip L. Brach, research assistant.

# The Surveyor's Notebook

*Reporting on Unusual Surveying Problems and Their Solutions*

Notekeeper: W. & L. E. Gurley, America's Oldest Engineering Instrument Maker

## How to prove a point ...about a point...with an Optical Plummet Transit

*William Dryburgh sights through his new Gurley Optical Plummet Transit.*

One windy day, William A. Dryburgh, engineer in charge at the job site of a Detroit construction project, had established a point using a conventional plumb bob. A check on his setup was important to its later use for tying in. A new Gurley Optical Plummet Transit, just demonstrated to him and to Robert Bryant, of Bryant and Detwiler Construction Company, was on hand.

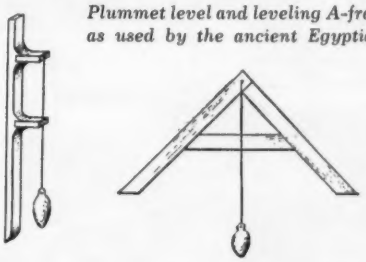
Setting up the new instrument over his point, he leveled up. Sighting in the Optical Plummet, he used the built-in shifting head tripod to bring the instrument directly over the point.

Satisfied that the instrument had remained level during shifting, he then took a sight on a target through his main telescope. Next he flipped his telescope without moving its upper or lower motion, taking a back sight on a target placed on the building behind him. His back sight did not check.

Double centering proved the instrument's perfect adjustment. Checking its levelness, he again tried fore and back sight with the same result. An obvious error existed; so he proceeded to "buck in" the Optical Plummet Transit from the targets, and found he had an error as established by his plumb bob. *Result: He kept the Optical Plummet Transit.*

**The plumb bob** has served men well for thousands of years. Changed very little since the Egyptian pyramid builders used it, its swing and sway can be exasperating—especially on windy locations. It is essentially inaccurate.

Gurley Optical Plummet Transits replace the outdated cord and bob with a method deriving precision from accuracy intrinsic in the laws of optics. Readings are instantaneous. Wind cannot blow it out of vertical—there is nothing to swing or gyrate. The built-in shifting head allows a 2-inch shift of instrument over point, giving ample leeway in initial setup. Rotating the instrument 180 degrees assures you of positive centering. *Write for new Bulletin OP-100.*



*Plummet level and leveling A-frame as used by the ancient Egyptians.*

### Ask to See the Variable Power Eyepiece

Variable Power is now *standard* on Gurley Optical Plummet Transits—and all other Gurley Transits and Levels. With "VP" you go from high to low and back again—with stops anywhere in between.

"VP" offers a clear, flat field, devoid of aberrations at any magnification. You have all the power required for the longest sight, and reduced power for local conditions. You will find visibility under poor lighting can be improved by use of lower magnification. Turbulent effect of heat waves is minimized with lower power. Write for "Facts on VP".

**GURLEY**

Surveying and Scientific Instrument Makers Since 1845

**W. & L. E. GURLEY, 518 FULTON ST., TROY, N. Y.**

Engineering and Surveying Instruments, Hydrological and Meteorological Instruments, Paper Testing Instruments, Optical Instruments, Reticle Manufacturing Facilities, Standard Weights and Measures

## Non—ASCE Meetings

**Air Pollution Control Association.** Annual meeting at the Hotel Statler in Los Angeles, Calif., June 22-26. For details write Harry M. Pier, Executive Secretary, Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh 13, Pa.

**American Institute of Chemical Engineers.** Fortieth national meeting at the Muehlebach Hotel in Kansas City, Mo., May 17-20. Information available from Raymond C. Mayer & Associates, 51 East 42nd Street, New York 17, N. Y.

**American Institute of Electrical Engineers.** Conference on Automatic Techniques co-sponsored with the American Society of Mechanical Engineers will be held in Chicago, Ill., May 11-13. For further information to ASME, Meetings Department, 29 West 39th Street, New York 18, N. Y.

**American Society for Engineering Education.** Conference and symposium on Applications of Economic Evaluation in Industry co-sponsored by the Engineering Economy Division of ASEE and the Engineering Economy Research Committee of AIIE at Carnegie Institute of Technology and the University of Pittsburgh in Pennsylvania, June 13-14. The registration fee is $25 with a special rate of $5 for academic personnel. Registrations and requests for further information should be sent to Markwick K. Smith, American Telephone and Telegraph Company, Room 1104, 195 Broadway, New York 7, N. Y.

**American Society of Mechanical Engineers.** Fourth Annual Design Engineering Conference sponsored by the machine design division of ASME and the Design Engineering Show produced by Clapp & Poliak, Inc. will take place at Convention Hall, Philadelphia, Pa., May 25-28. Information about the conference, hotels and advance registrations are available from Clapp & Poliak, Inc., 341 Madison Avenue, New York 17, N. Y.

**American Society for Testing Materials—American Society for Engineering Education.** Jointly sponsored symposium on Education in Materials at the ASTM annual meeting in Atlantic City, June 22-26. Information available from ASTM, 1916 Race Street, Philadelphia 3, Pa.

**Chamber of Commerce of the United States.** Forty-seventh annual meeting will be held in Washington, D. C., April 26-29. Advance registration and ticket forms available from the Chamber of Commerce of the United States, 1615 H Street, N. W., Washington 6, D. C.

**Concrete Reinforcing Steel Institute.** Annual meeting at the Greenbrier Hotel in White Sulphur Springs, W. Va., May 25-30. Additional information may be obtained from H. C. Delzell, Managing Director, Concrete Reinforcing Steel Institute, 38 South Dearborn Street, Chicago 3, Ill.

**Consulting Engineers Council.** Third annual general meeting at the Biltmore Hotel in New York, N. Y., April 28-May 3. Co-hosts will be the New York City and the New York State Associations of Consulting Engineers. Additional information available from Larry N. Spiller, Executive Secretary, Consulting Engineers Council, 326 Reisch Building, Springfield, Ill.

**Federation of European Petroleum Equipment Manufacturers.** Third Petroleum Equipment Congress in Paris, June 25-22. For further particulars and registration form write to the FECEP-FEPEM Secretariat General, III Congres Europeen, Equipment Petrolier, 44bis, Rue Pasquier, Paris—VIIIe, France.

**Industrial Health Conference.** 1959 Industrial Health Conference at the Hotel Sherman in Chicago, Ill., April 25-May 1. Registration and additional information may be obtained before April 20 by writing to Industrial Health Conference, Registration, Room 1313, 28 E. Jackson Blvd., Chicago 4, Ill.

**Institute of Traffic Engineers.** A Freeway Operations Seminar for the New York City Metropolitan Area at Bear Mountain State Park, Bear Mountain, N. Y., May 11-13. Further information may be obtained from Gordon K. Gravell, Metropolitan New York Section of the ITE, and Deputy Commissioner of Traffic in New York City, or from ITE, 2029 K Street, N. W., Washington 6, D. C.

**Instrument Society of America.** Fifth annual symposium on Instrumental Methods of Analysis at the Shamrock-Hilton Hotel in Houston, Tex., May 18-20. Write ISA, 313 Sixth Avenue, Pittsburgh 22, Pa.

**Purdue University.** Fourteenth Purdue Industrial Waste Conference sponsored by the School of Civil Engineering at the Purdue Memorial Union Building, Lafayette, Ind., May 5-7. Hotel reservations can be made at the Purdue Union Club, Fowler Hotel, Cedar Crest Hotel and Morris Bryant Hotel in Lafayette.

**Society of American Military Engineers.** Thirty-nine annual meeting in Washington, D. C., May 18-19. Information from SAME, 808 Mills Building, Washington, D. C.

**Society for Experimental Stress Analysis.** 1959 Spring meeting and exhibition on Experimental Techniques applied to Missile Structures and Space Vehicles at the Sheraton Park Hotel, Washington, D. C., May 20-22. Information from Robert O. Belsheim, General Chairman, 2475 Virginia Avenue, N. W.—Apt. 514, Washington 7, D. C.

**Western Snow Conference—Colorado River Forecasting Committee.** Joint meeting at the Mapes Hotel in Reno, Nev., April 21-23. Write Norman S. Hall, Soil Conservation Service, 1485 Wells Avenue, Reno, Nev.


IT'S NEW / It's from DORR-OLIVER

A DEGRITTING CLARIFIER

A new two-in-one unit for small sewage treatment plants, the Dorr Degritting Clarifier or Clarigester combines positive mechanical degritting with conventional clarification in a single tank. Applicable for maximum flows of 0.45 to 1.75 MGD, this new design incorporates an annular chamber around the Clarifier feed well.

As Clarifier feed enters the chamber, grit settles and is removed by rakes attached to the Clarifier skimming arm. Overflow from the grit chamber discharges over a weir into the feed well. A by-pass slide gate allows discharge of the feed directly into the Clarifier when desired.

This new design is equally adaptable to both Dorr Type 'A' Clarifiers and Dorr Clarigesters. In either case, it will remove troublesome grit from the raw sewage without the need for costly, separate grit handling facilities.

For more complete information on this new two-in-one unit write Dorr-Oliver Incorporated, Barry Place, Stamford, Connecticut.

DORR-OLIVER
INCORPORATED
WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
STAMFORD • CONNECTICUT • U.S.A.

*for heavy, high-speed traffic:*

# LACLEDE HIGHWAY REINFORCEMENT

The new Mark Twain Expressway, sweeping into St. Louis from rapidly-expanding northwest suburbs, will relieve a troublesome traffic-congestion problem. As it nears the downtown district, this modern freeway will be elevated for approximately one-half mile, spanning some of the city's most heavily traveled streets.

In this overpass alone, more than 700 tons of Laclede reinforcing steels have been used. And in many other highway projects throughout the midwest, Laclede steels are imparting the strength and durability needed to carry today's high-speed, high-volume traffic.

*General Contractor: Mary Construction Co., Cape Girardeau, Mo.*

LACLEDE®

**LACLEDE STEEL COMPANY**

SAINT LOUIS, MISSOURI ◆ Producers of Steel for Industry and Construction

MICROTOMIC
FIRED AT
2000° F

*Trademarks Reg. U.S. Pat. Off.*

Intense heat is important in the making of pencil lead. Under the supervision of Eberhard Faber pencil engineers, Microtomic leads are fired up to 2,000 degrees Fahrenheit in scientifically-controlled ovens. One more reason why Microtomic holds a finer point longer... produces rich, black lines... and is the natural choice of professionals. Bull's eye identifies each of 18 uniform degrees.

MICROTOMIC

**Proves Its Point Every Time**

*110th Anniversary, 1849–1959*

EBERHARD FABER
WILKES-BARRE, PA. • NEW YORK • TORONTO, CANADA


## Application for Admission to ASCE, Jan. 31-Feb. 28, 1959

### Applying for Member

SAMUEL BARNOW, Chicago, Ill.
GEORGE EDWARD, BERTRAM, Alexandria, Va.
JOHN DRAKE BRISTOR, Tulsa, Okla.
WINFRED WALTER BURDORFF, Augusta, Kans.
RAY WESLEY BURGESS, Baton Rouge, La.
PIETRO CELESTRE, Rome, Italy
CUSTER LAUREL COOKSON, Mobile, Ala.
ELLIOTT HAWES DEJARNETTE, III, Fort Knox, Ky.
WILLIAM HERBERT DELAY, Bulathkohupitiya, Ceylon
MEYER WOLFF DEUTSCHMAN, Miami, Fla.
WILLIAM EDGAR EHRENSPERGER, Atlanta, Ga.
SHAM LAL GUPTA, Skokie, Ill.
HAROLD DAMON GURNEY, Boston, Mass.
STANLEY STEPHEN HAENDEL, New York, N. Y.
RICHARD JOHN HARRIS, Harrisburg, Pa.
WILLIAM ARTHUR HEITMANN, Washington, D. C.
JAMES HART HOTTENROTH, Ft. Worth, Tex.
JOHN EDWARD JACOBSON, Houston, Tex.
JOSEPH RANDOLPH KEENE, Baltimore, Md.
KEITH DONALD LARSON, St. Paul, Minn.
TUH-FUH LEE, Singapore, Malaya
ERICH LORENZ, Harrisburg, Pa.
MAURICE NILSSON MCKENDRICK, Salt Lake City, Utah
PHILLIP MOSES, South Bend, Ind.
JOSEPH GARIBILDI PERRI, New York, N. Y.
WAYNE KITSON PLATT, Sacramento, Calif.
HENRY JULIAN PROSSER, South Bend, Ind.
HERBERT M. SCHWARTZ, Miami, Fla.
RALPH WILLIAM SEABRIGHT, Springfield, Ill.
CLARENCE EDWIN HENRY SMITH, Philadelphia, Pa.
CHARLES FRANCIS SMITH, Belton, Mo.
JOSEPH MIDDLETON STEELE, II, Philadelphia, Pa.
STANLEY HUBERT SUTTON, Cleveland, Ohio
ALBERT LEE TETLEY, SR., Baton Rouge, La.
CHARLES LEON TOWNSEND, Denver, Colo.
EDWARD BRYON TRUEWORTHY, JR., Butte, Mont.
JAMES ARTHUR TYSON, Jasper, Ala.
FRED WILLIAM ULRICH, Canton, Ohio
HERMAN CHARLES VOLLMER, Washington, D. C.
FRANK SAMUEL WYLIE, JR., Bloomington, Ill.
KENNETH BRADFORD YOUNG, Bethesda, Md.
ALBERT CHONG-FOOK ZANE, Honolulu, Hawaii

### Applying for Associate Member

NKATA KALU ABBA, Nigeria, West Africa
SYED SAGHIR AHMED RIZVI, Denver, Colo.
EDGAR LEVI ALLRED, Rolla, Mo.
GNANASUNDARAM MARIMUTHU ANDAVAN, Madras, India
MARSHALL LLOYD ANDERSON, Tucson, Ariz.
CURT E. BEAL, Hallowell, Me.
ROBERT EVANS BLACK, New York, N. Y.
JUAN MANUEL BONETTI-RAMIREZ, Ciudad Trujillo, Dominican Republic
JOHN COTTERELL CASSON, Springfield, Ill.
RICHARD GEOFFREY CASTLE, Los Angeles, Calif.
SAM ARTHUR BONNYI CHANG, Singapore, Malaya
ROBERT CHIERUZZI, Los Angeles, Calif.
SEYMOUR SHIN-MOH CHIU, Los Angeles, Calif.
HENRY LYNN COOK, Tacoma, Wash.
WALTER SAMUEL CRAIG, New York, N. Y.
BOBBIE WILBUR DAVIS, Dallas, Tex.
ARNOLD RICHARD DE ANGELIS, San Rafael, Calif.
ERNEST FREDERICK DUHRANT, Saskatchewan, Canada
ISMAIL ERGONENC, Jackson Heights, N. Y.
FRANK WILLIAM FEILER, Los Angeles, Calif.
EDWIN HOY FINSTER, Santa Ana, Calif.
CHARLES RICHARD FREEARK, Pasadena, Calif.
RAY WARREN GOEBEL, Wenatchee, Wash.
VERL DALE GROVES, Greeley, Colo.
JOHN GHOLSON HAGGARD, San Francisco, Calif.
DASEL EUGENE HALLMARK, Washington, D. C.
ELDON HAROLD HENRY, Tulsa, Okla.
CARL HAROLD HOLM, Ridgewood, N. J.
BOBBY JOE HOLT, Los Angeles, Calif.
KENNETH DEAN IMEL, Oklahoma City, Okla.
KENNETH JAMES IVES, Cambridge, Mass.
JOSEPH HORATIO JAMESON, New York, N. Y.
NEDDY COSTANDY JOUZY, W. Lafayette, Ind.
EULALIO JUAREZ-BADILLO, Mexico, D. F., Mexico
GEORGE WARREN KELLER, New York, N. Y.
LEROY WILSON KIDD, Roanoke, Va.
MARVIN BERNARD KOMANSKY, New York, N. Y.
ROBERT CLEOPHUS KIRK, Atlanta, Ga.
ALEXANDER KOWALSKI, Montreal, Quebec, Canada
CHARLES METZGER KUELL, Buffalo, N. Y.
EDWARD BRUCE LAING, New York, N. Y.
NOEL OSCAR ERNEST LAKIN, Leicester, England
EMMANUEL LARTEY, Evanston, Ill.
JOHN HURD LAWDER, Cayucos, Calif.
ROBERT ALFRED LECOUNT, Boston, Mass.
MURRAY DAVID LESTER, Montreal, Canada
PAUL LEVIHN, Teheran, Iran
CARL THOMAS LLOYD, Mariette, Ga.
JOHN LONERGAN, London, England
JAMES JOHN MAHOS, Milwaukee, Wis.
ROBERT DANIEL MANN, Detroit, Mich.
JOHN ARTHUR MARTIN, Denver, Colo.
RICHARD ALFRED MASON, Bridgeport, Conn.
KEITH EDWARD MCKEAN, Los Angeles, Calif.
LOUIS ROBERT MOFFA, Collingswood, N. J.
FREDERICK WILLIAM MUELLER, Baltimore, Md.
CRAWFORD HUGH MUNRO, New South Wales, Australia
NORMAN EDGAR MURRELL, Hicksville, N. Y.
ROBERT WILLIAM OSBORNE, N. J.
NACI AHMET OZKALPER, Brooklyn, N. Y.
EMMANUEL PARTHENIADES, San Francisco, Calif.
CHARLES PEMBERTON PERRAULT, Baton Rouge, La.
NICHOLAS WORTHINGTON PHILIP, New York, N. Y.
JOHN MICHAEL PROMINSKI, Ft. Lauderdale, Fla.
FRANK EDWARD REID, Cleveland, Ohio
JOHN JOSEPH REID, Lubbock, Tex.
REIMAR ALBERT RETTIG, Boston, Mass.
HENRY CLIFFORD RICKER, JR., Baltimore, Md.
CHARLES EDDY RUPPE, Atlanta, Ga.
LOUIS GUELO SILANO, Seaford, N. Y.
STEPHEN RAYMOND SIMCO, Detroit, Mich.
HUGH ADAMS SMITH, JR., Walla Walla, Wash.
THOMAS GEORGE SMITH, Marysville, Calif.
MURDOCK MURPH SNELLING, JR., Birmingham, Ala.
MERVIN JOHN STEWART, Evanston, Ill.
WILLIAM LEWIS STRAIT, Beaumont, Tex.
WERNER STUMM, Cambridge, Mass.
JEROME JOSEPH THOMAS, Poughkeepsie, N. Y.
ALEXANDER RICHARD THOMSON, Montreal, Canada
DAVID YUNG CHOY TOM, Honolulu, Hawaii
EWELL RANDALL VIGDORTH, Nashville, Tenn.
WILLIAM BUXTON WALL, Savannah, Ga.
CHARLES ROWLAND WANNER, JR., Dallas, Tex.
CHANG SHU WEI, Singapore, Malaya
JOSEPH WEITZMAN, New York, N. Y.
DONALD SHERWOOD WILD, West Hartford, Conn.
DONALD MUSETH WILLIAMS, Seattle, Wash.
LENORD BATEMAN YARGER, Rapid City, S. Dak.
HOWARD ANDREW YORK, Milbrae, Calif.
CHARLES NELSON YOUNG, Ephrata, Wash.
ROBERT FREDERICK YTTERBERG, New York, N. Y.

### Applying for Junior Member

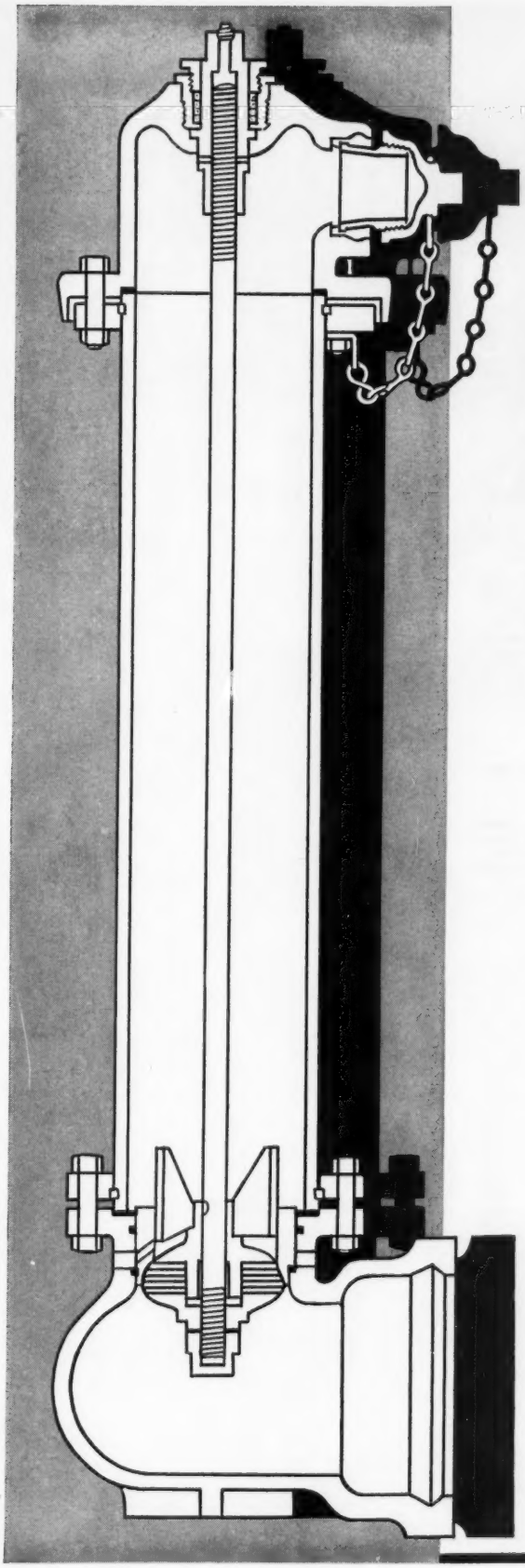
JAY ROBERT ANDERSON, Ogden, Utah
PRAKASH BHATIA, Bangalore, India
JUAN J. BOLINAGA I., Stanford, Calif.
WILLIAM ALBERT BRIGGS, Columbus, Ohio
SEYMOUR PHILIP COHEN, Los Angeles, Calif.
JOHN STOW CUNIBERTI, Sacramento, Calif.
THOMAS ELLSWORTH DE WITTE, Des Moines, Iowa
HASAN NEDIM DULAGIL, New York, N. Y.
GEORGE JAMES GUMMIG, Kansas City, Mo.
NABIL HADAWI, New York, N. Y.
EARL GILFILLAN HAGADORN, JR., Palo Alto, Calif.
GEORGE CONRAD HOFMEIER, Baltimore, Md.
PAUL MONROE KENNER, Baltimore, Md.
PEDRO EMILIO LEVANO MESIAS, Lima, Peru
RICHARD JOSEPH MCCORMACK, Orlando, Fla.
DAVID R. MCDERMOTT, Cleveland, Ohio
JAMES FRANCIS MCEVADDY, New York, N. Y.
KENNETH LEROY MILFORD, Kansas City, Mo.
MILTON HERMAN MOOS, Columbus, Ohio
DAVID MORRIS, Raleigh, N. C.
GEORGE GARZA RANGEL, San Antonio, Tex.
OTTO TESKE, JR., Chicago, Ill.
JOHN ROY THURSTON, Washington, D. C.
ANTONIO JOSE TRAVIESO CARDONA, Caracas, Venezuela
THEODOSIOS TROCHALAKIS, Kuwait
BARRETT JOSEPH WILSON, New York, N. Y.
AYHAN AHMET YASA, Cincinnati, Ohio

*[Applications for Junior Membership from ASCE Student Chapters are not listed.]*

## New Publications

**Stream clean-up** . . . . Cleaner streams and the development of robot monitors to maintain a continuous check on sanitary conditions are forecast in the recent annual report of the Ohio River Valley Water Sanitation Commission. The report may be obtained by addressing Commission headquarters, 414 Walnut Street, Cincinnati 2, Ohio.

**Construction materials and design** . . . . A wide range of research is covered in recent reports of the California State Division of Architecture. Two of these are available from the California State Printing Office, Documents Section, Sacramento 14, Calif. They are "Behavior of Prestressed Concrete Beams at Transfer" by A. C. Scordelis, T. Y. Lin, and H. R. May, Series 100, Issue 3, October 1957, price $1.75, plus sales tax; and "Shearing Strength of Reinforced and Prestressed Concrete Lift-Slabs" by Messrs. Lin, Scordelis, and May, Series 100, Issue 4, October 1957, price $1.50, plus sales tax. Six reports on lumber research are available from the Forest Products Research Center, State of Oregon, Box 571, Corvallis, Ore.



# R.D. WOOD HYDRANT

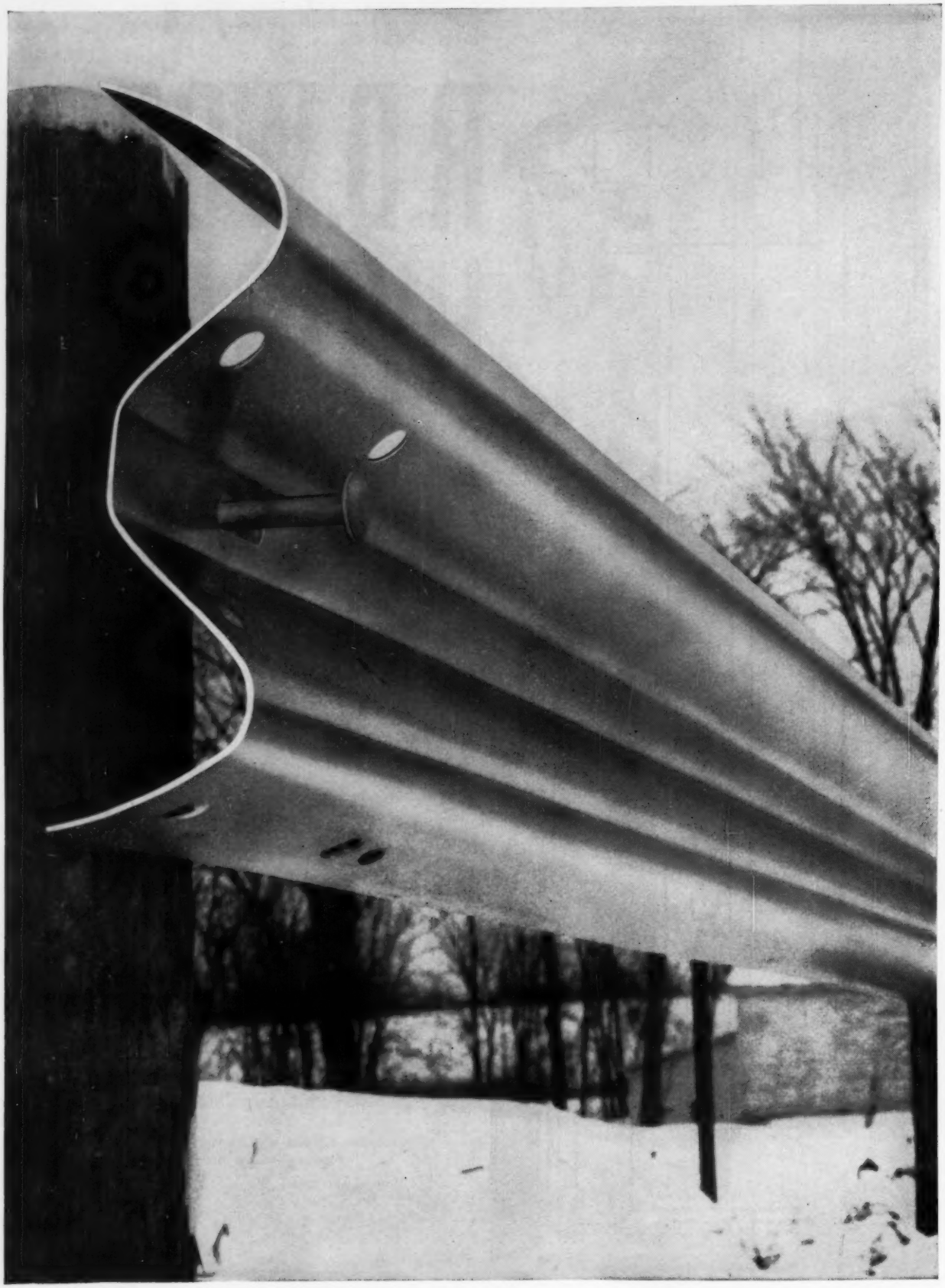
**THE R. D. WOOD HYDRANT SUPPLIES MAXIMUM RELIABILITY AT MINIMUM COST**

- Valve opens against water pressure—water pressure holds it closed in case of accident
- Every point of friction is protected by at least one bronze surface
- Head revolves 360°; simply loosen bolts and rotate
- Optional break-point flange with frangible coupling in hydrant stem makes it unnecessary to excavate in case of a broken hydrant
- Available for bell, flange and mechanical pipe connections; with conventional or "O" ring packings

## R. D. WOOD COMPANY

**Public Ledger Building, Independence Square**
**Philadelphia 5, Pa.**

Manufacturers of Mathews Hydrants and "Sand-Spun" Pipe
(centrifugally cast in sand molds)



# safety everyone can afford

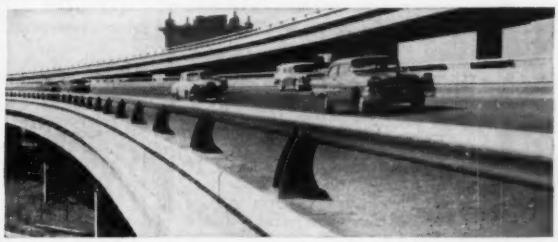
## New Alcoa Aluminum Beam Guard Rail

Alcoa's new aluminum beam guard rail for highways combines maximum safety with modern appearance and minimum upkeep. Fabrication from high-strength aluminum alloys assures increased energy absorptive capacity.

Alclad aluminum provides permanent resistance to corrosion and means direct savings in maintenance costs. It resists the corrosive effects of road salts, industrial fumes and airborne grit. No painting—on or after installation—is necessary. Initial cost, only slightly higher than ordinary guard rail, is rapidly equalized by the savings in painting and other maintenance. Alcoa® Beam Guard Rail is available with aluminum posts, too.

Now is the time to get the full story on Alcoa Beam Guard Rail, Lighting Standards, Highway Signs, Overhead Structures and Chain Link Fencing. To learn how they help stretch taxpayers' highway dollars, call your nearest Alcoa sales office or write: Aluminum Company of America, 1913-J Alcoa Building, Pittsburgh 19, Pennsylvania.

**BRIDGE RAILINGS** of Alcoa Aluminum deliver maximum return for tax dollars, because first cost is last cost. Lightweight aluminum is easier to handle and faster to erect. Corrosion-resistant Alcoa alloys never need maintenance; they end painting costs that commonly run to a dollar per lineal foot per year.



**OVERHEAD SIGN STRUCTURES** eliminate periodic maintenance and the accompanying traffic tie-ups when they're built of Alcoa Aluminum. Tubular truss designs and single-chord spans meet any requirement and their lightness permits faster erection with minimum man power and equipment.

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

*Your Guide to the Best in Aluminum Value*

For Exciting Drama Watch **"Alcoa Theatre,"** Alternate Mondays, **NBC-TV** and **"Alcoa Presents,"** Every Tuesday, **ABC-TV**

# ENGINEERING SOCIETIES PERSONNEL SERVICE, INC.

NEW YORK 8 W. 40th ST. | CHICAGO 84 E. RANDOLPH ST. | SAN FRANCISCO 57 POST ST.

These items are listings of the Engineering Societies Personnel Service, Inc. This Service, which cooperates with the national societies of Civil, Electrical, Mechanical, Mining, Metallurgical and Petroleum Engineers, is available to all engineers, members or non-members, and is operated on a non-profit basis. If you are interested in any of these listings, and are not registered, you may apply by letter or resume and mail to the office nearest your place of residence, with the understanding that should you secure a position as a result of these listings you will pay the regular employment fee of 5 percent of the first year's salary if a non-member, or 4 percent if a member. Also, that you will agree to sign our placement fee agreement which will be mailed to you immediately, by our office, after receiving your application. In sending applications be sure to list the key and job number.

When making application for a position include 8 cents in stamps for forwarding application to the employer and for returning when possible.

A weekly bulletin of engineering positions open is available at a subscription rate of $3.50 per quarter or $12 per annum for members, $4.50 per quarter or $14 per annum for non-members, payable in advance.

## Men Available

PROJECT ENGINEER, J.M. ASCE, C.E., 30. Two and one half years experience on industrial and commercial construction; two and one half years on public works; one and one half years as project engineer for consulting firm majoring in sanitary projects. Location desired: Florida or East. C-437.

CONSTRUCTION SUPERINTENDENT, J.M. ASCE, B.S.C.E., 33. Available May. Supervisory experience on industrial, commercial and institutional buildings, and on paving and earthwork. Interested in management opportunity. Will relocate. C-438-927-Chicago.

ENGINEERING MANAGEMENT AND SALES, J.M. ASCE, B.S.C.E., 30. One year research and development of army type bridge and prefab buildings; two and one half years' steel design steel fabricator in buildings and hangars; two years' field service for steel fabricator in buildings, hangars and towers; one year and four months' product management including promotion, sales, engineering and construction of mechanical parking garages. C-439-937-Chicago.

CONSTRUCTION MANAGER, A.M. ASCE, B.S.C.E., 38. Twelve years' responsible charge of construction for general construction company. Bid to completion activities. Registered engineer several states. Management or construction abilities any size engineering projects. Location desired: Domestic or Foreign. C-440-934-Chicago.

SANITARY ENGINEER, J.M. ASCE, B.S.C.E., 28. Four and one half years' of investigation and design of sewage treatment plants and water treatment plants and related systems. One year managerial experience in U.S.A.F. P.E. license in Michigan. Location, West or Midwest. C-441-931-Chicago.

EXECUTIVE POSITION OR PROFESSOR, M. ASCE, B.S., M.S., Ph.D., 38. Three and one half years experience in administrative position with architectural engineers and six years' supervision plus design with industrial engineers. Author of several articles and a book. Location desired: Midwest preferred. C-442-929-Chicago.

STRUCTURAL ENGINEER, A.M. ASCE, M.S.C.E., 38. Twenty years of experience including supervision on both design and construction. Projects include major and minor bridges, industrial and commercial buildings—steel, concrete, masonry, wood. Seek connection with engineering or architectural firm. Location desired: Preferably San Francisco Bay area. C-989-San Francisco.

CONSTRUCTION ENGINEER, J.M. ASCE, B.S. and M.S. C.E., 24. One and a half years experience in Central America, general surveying and mapping, construction supervisor on levee, canal, railroad, and pumping facilities. One year Texas Highway Department, Expressway Division, roadway design section, storm sewer and culvert design, alignment calculations and quantity takeoff. Speaks Spanish. Location desired: Mexico, Central-South America. C-413-San Francisco.

DEPARTMENT HEAD, A.M. ASCE, B.S.C.E., M.S. Sanitary Engineer and Business Administration, 36. Twelve years' structural design in concrete and steel structures. Specifications and promotional works. Supervision of engineers and draftsmen. Completee charge of projects. C-808-San Francisco.

MANAGEMENT, M. ASCE, M.C.E., 43. Varied experience regular military engineering services; construction, maintenance, design, planning, contract negotiation and supervision, management surveys, personnel administration. Fluent writer. P.E. license—New York. Prefer project management, management surveys, public works. Location desired: eastern U.S. C-443.

CIVIL ENGINEER, A.M. ASCE, Italian Diploma Civil Engineering, member of International Society of Soil Mechanics and Foundation Engineering, 37. Fourteen years progressive experience in design, research, surveying and consulting in civil and soil engineering. Available April 1, 1959. Location desired: Madison or Ithaca or near a town having a good university. Will travel at own expense if required. Presently located in Italy. C-444.

## Positions Available

CIVIL ENGINEERS, with experience in water supply or sanitary engineering, for a consulting engineer. Location, northern New Jersey. W-7182.

ASSISTANT GENERAL SUPERINTENDENT, civil graduate, with at least five years' supervisory engineering, planning and administrative experience in municipal fields, including zoning and land acquisitions. Salary, $8,470 a year. Location, suburban New York. W-7178.

STRUCTURAL DESIGNER, graduate civil, with a minimum of five years experience; N.Y. State or other state license preferred. Will design, analyze, detail all types of structures in steel and concrete and make necessary structural and architectural drawings for factory buildings and processing equipment. Structures in steel would include all types of buildings, towers of various kinds; also


HYDROLOGIC ENGINEER

Five to ten years experience; minimum two, preferably five with USGS. Considerable foreign travel. Salary open. Send complete personal and experience record to

*Personnel Manager*

HARZA ENGINEERING COMPANY

400 W. MADISON STREET
CHICAGO 6, ILLINOIS



**Designing Engineer**—in Charge of Designing Office, to review and approve designs by consulting firms. Required experience, 10 years responsible charge of civil engineering design in hydraulics, earth dams, water supply structures and equipments, specifications.

*Prof. Eng. Lic. required.*

**Assistant Designing Engineers** — to review and approve designs of consulting firms.
Required experience, 6 years responsible civil engineering design in hydraulics, earth dams, water supply structures and equipment, specifications.

*Prof. Eng. Lic. required.*

**Senior Engineers** — required experience 4 years civil engineering design in hydraulics, water supply structures, preparation of drawings and estimates.

**Department of Conservation and Economics Development**
*State of New Jersey*
219 West State Street
TRENTON, NEW JERSEY

supports and foundations for all types of machinery and equipment. Salary, $7,200-$10,200 a year. Location, upstate New York. W-7166.

ARCHITECTURAL ENGINEER, with eight to fifteen years experience in industrial office, laboratory and factory. Must be registered. Salary open. Location, Midwest. W-7134.

PLANNING ENGINEERS. (a) Chief planning engineer, civil-hydraulic, experienced in water resource development multi-purpose structures; river basin total yield; flood control, municipal and industrial supply, irrigation and related subjects; economics water use. Salary, to $16,000 a year. (b) Planning engineer, civil-hydraulic, to coordinate reports on several adjoining river basins. Should have experience in total river basin water resource control and development. Salary, $12,000-$15,000 a year. (c) Planning engineer, civil-hydraulic, for river basin planning. Develop and review hydrology and hydraulic design, preliminary structural design, costs. Salary, $12,000-$15,000 a year. (d) Planning specialist, civil-hydraulic (or economic geographer), to analyze potential water use of several river basins, develop economics of alternate uses of water. Salary, $12,000-$15,000 a year. (e) Hydrologists, for river basin yield and control studies. Salary, $9,000-$12,000 a year. (f) Project engineer, for report writing. River basin development plans. Salary, to $12,000 a year. Two to three years' work. Federal Service. Location, Southwest. W-7149.

SENIOR ESTIMATOR, civil graduate, with at least five years experience covering take-off, pricing and handling sub-contractors on general building construction projects ranging from $100,000 to $3,000,000. Salary, $8,000-$10,000 a year. Location, New Hampshire. W-7148.

MANAGER OF TECHNICAL OPERATIONS, to act as assistant to owner of a firm practicing in the area of heavy civil engineering design and supervision of construction. Must have at least ten years experience in the tecehnical production echelons of engineering, and have a record of at least two to three years' in an administrative capacity either in the private engineering field or in a governmental agency. Must be able to meet and negotiate with clients. Salary open. Location, New York, N. Y. W-7144.

ASSISTANT PROFESSOR for Department of Civil Engineering, to teach and assist in teaching courses in the fields of surveying, photogrammetry, transportation and construction. Salary negotiated on basis of experience, etc. Available September, 1959. Location, upper New York State. W-7132.

CIVIL ENGINEER, graduate, with three to five years experience in municipal utilities. Work will be in the design of structures, water supply and distribution systems, water treatment, sewers, pumping stations and sewage treatment facilities. Salary open. Location, West. W-6926.

ENGINEERING CONSTRUCTION MANAGER, SALES, to take complete charge of construction contracts, evaluate and determine type company should bid on and know market area in Central and South America for large engineering, architectural and construction company. Should know Spanish. Salary, $35,000 a year, plus bonus. Headquarters, either southwestern U.S., Central America. W-7112.

STRUCTURAL ENGINEER, civil graduate, with about ten years design experience covering industrial buildings and considerable power plants. Salary, $10,000-$12,000 a year. Location, New York, N.Y. W-7025.

SENIOR BUILDING CONSTRUCTION ENGINEER, registered architect or professional engineer in New York State and two years engineering or architectural field experience in the supervision of building construction projects. Duties will include inspection of building construction projects and maintenance programs; review of plans, specifications and estimates for building construction and assistance in budget review of proposed capital construction projects. Salary, to start, $7,500 a year. Location, upstate New York. W-7074.

TEACHING PERSONNEL for Department of Civil Engineering, to teach the normal civil engineering courses such as strength, dynamics, surveying and related courses. Salary, 8½ month college year, contingent upon education and experience. Available for the 1959-1960 college year. Location, Pennsylvania. W-7005.

CONSTRUCTION MANAGERS with extensive and overall responsibility for industrial construction, especially in fertilizer (urea) and paper and pulp. Location, Foreign. F-6964.

TEACHING PERSONNEL. (a) Department head for civil engineering department, Ph.d., with university and administrative experience and ability to initiate and develop research and graduate work. Salary, $8,500-$14,500 a year. (b) Lecturer or Professor to teach and do research in soil mechanics and transportation engineering. Salary dependent on qualifications. Medical, hospital and pension plans in effect. Rapidly developing graduate study and research programs. Location, Canada. F-6944.

ENGINEERS. (a) Civil engineering designer—hydraulics, sanitary; graduates, experience in hydraulics or municipal work, for design of water supply systems, hydraulic structure, dams, irrigation canals. (b) Report writer, C.E.; with extensive experience in hydraulics, sanitary, for preliminary report. Retired man acceptable. (c) Design, heating and ventilating, air conditioning, mechanical-electrical, for design relating to mechanical-electrical; pumping plants, buildings. Salary, $6,000-$10,000 a year. Discuss relocation cost and placement fee with employer. Location, Shasta County, California. S-4184.

FIELD ENGINEER, CIVIL; registered C.E. California, with construction experience, to check and sign drawings that were made in California by large construction engineering company building ammonia plant near Fresno. Will be responsible for compliance with California code on change orders. Salary, $800-$900 for about ten months work. Location, Fresno County. S-4174.

OFFICE AND FIELD ENGINEER, irrigation and distribution, C.E., preferably registered in California, four to six years experience related to design and construction of canals, irrigation structures, water distribution; for field and office. Design, estimate, check plans, survey, layout and inspect field construction. Salary, $6,000 and up a year. Discuss payment of placement fee with employer. Location, central California. S-4167.

JUNIOR CIVIL ENGINEERS, irrigation, water distribution, B.S., with one or two years experience preferably in irrigation and water distribution, for design office work, under registered engineer. Salary, $6,000 and up a year, depending on experience. Location, San Joaquin Valley. S-3850.

DIRECTOR OF PUBLIC WORKS; must be California registered engineer, with five years municipal or similar experience. All of normal public works functions of municipality including water system, but not including a sanitary sewer system. Salary, $7,980-$9,972 a year. Location, Napa County, California. S-4157.

SOIL MECHANICS ENGINEER, preferably with advanced degree, with experience in analyses and able to write reports, for consulting engineering firm specializing in soil mechanics and foundation engineering. Salary, $7,000-$9,000 a year. Location, Northwest. S-4149.

HYDRAULIC ENGINEERS, Public Utility: (a) Graduate C.E., with six years experience in hydrologic investigations, under direction, to conduct studies, related to water supply planning, project development, protection and development of water rights. Salary, $6,732-$8,688 a year. (b) With four years experience related to water rights, to compile and analyze data for protection and development of water rights. Salary, $6,338-$8,088 a year. Location, Colorado. S-4147.

STRUCTURAL ENGINEER, Design-Consultant, graduate C.E., preferably registered. Will consider C.E. with structural engineering experience and qualified to work as project engineer for established consultant. Prestressed concrete experience desirable. Some travel required. Salary and bonus. Location, San Francisco. S-4146.

CIVIL ENGINEER, graduate or equivalent, with experience in surveying and preparation of maps; to work in land department office of large industrial corporation. Location, Alabama. W-7232.


# ENGINEERS

**PERMANENT OPENINGS FOR QUALIFIED MEN EXPERIENCED IN THE DESIGN OR SPECIFICATIONS FOR**

# AIRPORTS
# BRIDGES
# BUILDINGS
# HIGHWAYS
# RAILROADS

**PREFER GRADUATE REGISTERED ENGINEERS WHO SEEK LONG RANGE EMPLOYMENT WITH AMPLE OPPORTUNITY FOR PROFESSIONAL DEVELOPMENT AND ADVANCEMENT IN A STEADILY EXPANDING AND GROWING ORGANIZATION.**

Paid vacation, sick leave, holiday, overtime. Excellent Employee Benefits Plan provides retirement income and other benefits Blue Cross, Blue Shield available. Moving allowance.

Work will be in the general offices in St. Louis. Interviews can be arranged in Washington, D. C., and San Francisco.

•

*Please write fully, including salary data, to*

**SVERDRUP & PARCEL ENGINEERING CO.**

*ENGINEERS — ARCHITECTS*

915 OLIVE • ST. LOUIS 1, MO.

Ashes, coal and other substances under foot often make solid floors in boiler rooms unsafe.

Such hazardous materials cannot accumulate on a floor made of Irving open steel grating. Debris falls right through, making floors always clean. Dangerous fumes can escape through open grating. Floors made of Irving Grating are clean, safe at all times . . . no ankle turning, tripping, slipping, hot foots. It is fireproof, self-ventilating.

*Manufacturers of Riveted, Pressure-Locked, and Welded Gratings of Steel, Aluminum and other metals.*

**"A FITTING GRATING FOR EVERY PURPOSE"**

**IRVICO**

**IRVING SUBWAY GRATING CO., Inc.**
*Originators of the Grating Industry*

**Offices and Plants at**
**5008 27th St., LONG ISLAND CITY 1, N. Y.**
**1008 10th St., OAKLAND 23, CALIFORNIA**

# RECENT BOOKS

*(added to the Engineering Societies Library)*

### ASTM Standards on Mineral Aggregates and Concrete

Contains 101 standards specifications, methods of testing, recommended practices and definitions of terms for mineral aggregates, concrete, concrete curing materials, and expansion joint fillers, as well as miscellaneous related specifications. Of the included standards 46 are new or revised since the 1956 edition, which is superseded by the present edition. (Published by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., 1958. 818 pp., paper $4.75.)

### Advanced Mechanics of Fluids

An advanced sequel to the editor's earlier work, "Elementary Mechanics of Fluids." The goal of the present volume is the development of research methods, therefore the theoretical approach is given primary emphasis. Among the topics discussed are irrotational flow, conformal representation of two-dimensional flow, laminar motion, turbulence, boundary layers, and free-turbulence shear flow. (Edited by Hunter Rouse. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1959. 444 pp., bound. $9.75.)

### Careers and Opportunities in Engineering

The author indicates what personal traits and abilities are needed for success in various fields of engineering and discusses educational requirements and engineering courses. The actual work performed by engineers in different areas is described as are salaries and prospects for advancement. Also included is a brief history of engineering and a chapter on the opportunities for women. (By Philip Pollack. E. P. Dutton and Company, Inc., 300 Fourth Avenue, New York 10, N. Y., 1959. 140 pp., bound. $3.50.)

### Disposal of Radioactive Waste

Provides information relating to the basic data on which the safe limits for radioactive discharge are considered. Discusses the formation and nature of radioactive waste, the biological effects of radiation, discharge to the natural environment, and the treatment of airborne wastes, liquid effluents, and solid wastes. The problems likely to arise in the future and the means of coping with them are considered, as is the utilization of the individual fision products. (By K. Saddington and W. L. Templeton. The Macmillan Company, 60 Fifth Avenue, New York 11, N. Y., 1959. 102 pp., bound $3.50.)

### Engineering Manual

Brings together in one handy volume data and methods used in the architectural, chemical, civil, electrical, mechanical, and nuclear engineering fields. Mathematics, mathematical tables, and physical and chemical data common to all the engineering sciences are presented in sections prefacing the manual, and additional tables, graphs, and formulas are included in the appropriate sections. (Editors-in-chief John H. Perry and Robert H. Perry. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y., 1959. Various pagings, bound. $9.50.)

### Field Inspection of Building Construction

Following a discussion of the job of the inspector, several chapters cover various phases of construction: the preliminary, foundation, structural framing, intermediate, and finishing stages. Because of the complex problems of inspecting concrete work, a special chapter is devoted to this material. Responsibilities are defined and explained for such matters as quality of materials, quality of workmanship, coordination of work by different trades, schedules, storage of materials, provision of utilities and services, safeguarding of work in place, and safety precautions. (By Thomas H. McKaig. F. W. Dodge Corporation, 119 West 40th Street, New York 18, New York, 1958. 352 pp., bound. $9.35).

### Numerical Analysis and Partial Differential Equations

The first portion of the book deals with recent developments in numerical analysis, which is viewed by the author as a means of devising and evaluating numerical techniques for computers. Emphasis is placed on Russian contributions to this field. The second part studies the work which has been done in linear partial differential equations since 1953. Methods are given which are applicable to wide classes of equations, and in most cases results are stated in the form of definite theorems for the sake of easy reference. Volume V in "Surveys in Applied Mathematics". (By George E. Forsythe and Paul C. Rosenbloom. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1958. 204 pp., bound. $7.50.)

### Plastic Analysis of Structures

Presents the techniques necessary in the analysis of structures beyond the plastic limit, and the conditions under which a plastic analysis is appropriate. The first part of the volume treats in detail the application of plastic methods to frame-type structures whose principal strength lies in their resistance to bending, and discusses such topics as elastic plastic deformations, variable and repeated loading, and direct procedures of design. The second part is concerned with combined stresses in beams, circular plates, and circular cylindrical shells. (By Philip G. Hodge, Jr. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y., 1959. 364 pp., bound. $10.50.)

### Plastic Design of Steel Frames

In addition to presenting simple plastic theory and methods of plastic analysis, such secondary design considerations as the influence of shear force, axial force, and buckling are reviewed. Using plastic analysis as a base, design procedures are given for proportioning building connections with particular reference to welded connections. A special feature is the chapter on "Design Guides" which provides in chart form the analysis and design procedures and the secondary design guides presented in the book. (By Lynn S. Beedle. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1958. 406 pp., bound. $13.00.)

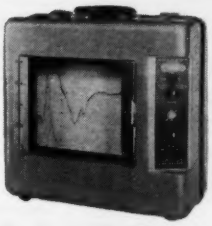
### Timber Engineering Design Handbook

Methods of design and construction which will produce soundly engineered structures are given, and the various factors contributing to the efficient and economic use of wood are discussed, including its fundamental structure, seasoning, and preservation. Among those subjects receiving special attention are the design of flued laminated structures; plywood in built-up beams and stressed skin construction; the prevention of deterioration in timber structures; and procedures for proof testing timber structures. (By R. G. Pearson and others. Commonwealth Scientific and Industrial Research Organization, Australia, in association with Melbourne University Press; distributed by the Cambridge University Press, 32 East 57th Street, New York 22, N. Y., 1958. 248 pp., bound. $6.00.)

### Library Services

Engineering Societies Library books may be borrowed by mail by ASCE members for a small handling charge. The Library also prepares bibliographies, maintains search and translation services, and can supply a photoprint or microfilm a copy of any items in its collection. Address inquiries to R. H. Phelps, Director, Engineering Societies Library, 29 West 39th Street, New York 18, N.Y.

*USED BY*
*U.S. ARMY ENGINEERS,*
*NAVY, COAST GUARD*



**ES 130 AF**

## SURVEY DEPTH RECORDER

For salvage, submarine survey, improved all-purpose model with new Narrow Beam single transducer. Completely portable, lightweight . . . four scale ranges 0/65 feet, 60/125 feet, 120/185 feet and 180/245 feet. Accuracy ≐ ½ of 1%. Operates on 6 or 12 volts D.C. or 115 volts A.C. Base price **$1175.**

## UNDERWATER METAL LOCATOR

**UML 20**

Pinpoints ferrous and non-magnetic metals in fresh or salt water . . . depths to 180 feet. Watertight, non-corroding, supersensitive. Easy-to-read "MEMETER". Weighs only 1½ lbs. submerged. **$545** including batteries. Immediate delivery.

*Brochures mailed on request • All prices F.O.B. N. Y.*
*Write for name and address of Dealer nearest you*

## BLUDWORTH MARINE

Division of KEARFOTT COMPANY, Inc.
1500 Main Avenue, Clifton, N. J.
**A SUBSIDIARY OF**
**GENERAL PRECISION EQUIPMENT CORPORATION**

GPE

## STAINLESS STEEL
### Well Casing to meet every Soil Condition

from 6" to 36" diameter and 4 different perforations to meet your special requirements. For a permanent, trouble free well put down Thompson Stainless Steel Casing.

## Parshall Measuring Flume

Accurate to .02 regardless of stream velocity, self cleaning, easily read, approved by State Engineers. 6" to 12' throat widths galvanized or black. Ideal for water and sewage control.

## Automatic Control Gates

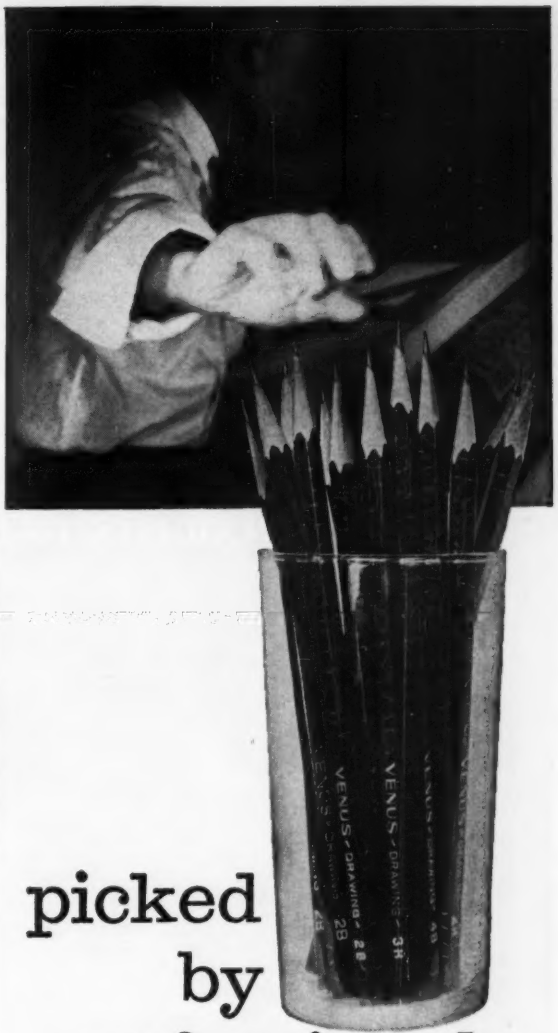
Control water levels, upstream or downstream, assures equitable distribution 24 hours a day . . . entirely self operating . . . no gate keeper necessary. Prevents costly washouts and flood damage. Proven in USA, Europe and Africa. Write for full information . . . there may be an automatic gate near, for your inspection.

*Ask for catalog on* TP 9-5

☐ **Well Casing** ☐ **Parshall Measuring Flumes**
☐ **Custom Fabrication** ☐ **Automatic Water Control Gates**

**THOMPSON PIPE & STEEL CO.**
**3017 Larimer Street** **Denver 1, Colorado**





# picked by professionals

Reach for a Venus drawing pencil . . . and get the clearer, consistent, precision line blueprint and drafting work demands. The lead in all 17 degrees of Venus drawing pencils is homogenized by the exclusive Venus Colloidal Process. Result: sharper prints . . . smudge-free tracings. Clean erasures are easy to make.

And because Pressure-Proofing seals the lead to the wood along its entire length, the Venus is stronger, holds a needle point longer. See why Venus sets the standard for fine drawing pencils. Also try Venus Refill drawing lead that fits all holders.

*SEND FOR the Venus Technical Test Kit. State degree wanted—also choice of pencil or refill lead.*

*Venus . . . trademark of fine craftsmanship in Pencils & Pens*

## VENUS drawing pencils

©VENUS PEN & PENCIL CORPORATION, LEWISBURG, TENN.

# CATALOG DIGESTS of ENGINEERING and INDUSTRIAL interest

### 1 AERIAL MAPPING

**Aero Service Corporation**—Literature covering new and more economical applications of varied aerial mapping services is offered. These include aerial photography, topographic and planimetric maps from an aerial photographic base, precise aerial mosaics, and plastic relief maps. Services discussed are used in highway design, plant engineering, industrial development, city planning, and tax maps.

### 2 ALL-PLY PANEL FORMS

**Superior Concrete Accessories, Inc.**—Some of the features of the All-Ply Panel Forms included in Bulletin AP-59 are: strength; less bulk; weighs less than 5 lb per sq ft; panels may be erected horizontally or vertically; no metal or wooden frames; and flush joints prevent unsightly marks on concrete face. Photographs of the wide range of applications are also contained in the brochure.

### 3 ALL-PURPOSE EARTH AUGER

**Acker Drill Co., Inc.**—will send free of charge a copy of the Bulletin 40-R, describing the all-purpose earth auger, which is a highly versatile and useful unit for developing rock profiles, soil sampling operations, diamond core drilling, and highway test coring. The brochure is profusely illustrated.

### 4 ALUMINUM GRATING

**Borden Metal Products Co.**—A brochure by way of diagrams and photos illustrates the properties and use of aluminum floor gratings. Also shown are tables of their specifications. A description of safety grating and aluminum safety steps is featured.

### 5 ALUMINUM GRATING

**Kerrigan Iron Works, Inc.**—An 8-page catalog on three types of aluminum grating, Roll-Lock, Riveted and Pressure-Locked, is available. It contains load tables and engineering data on all types and in-use illustrations or photographs. Lightweight, non-magnetic, noncorrosive, aluminum grating has no maintenance cost and its high strength insures many years of service.

### 6 ALUMINUM GRATING

**Washington Aluminum Co.**—A catalog on Aluminum Grating and the complete Aluminum Fabrication facilities for industry is available. The grating is non-sparking, nonmagnetic and maintenance-free. Its special I-Beam design extrusion gives it superior structural strength, yet it is light in weight. Another feature is that cutouts are flat bar banded by a continuous weld. The grating is available in upset pattern for maximum nondirectional, non-skid safety or plain design.

### 7 AMERICAN DUCTILE IRON

**American Cast Iron Pipe Co.**—This 36-page illustrated catalog gives valuable technical information including grades, specifications, dimensions and weights, uses and applications of American Ductile Iron products. Typical applications include underground piping, industrial piping, well casing, tanker piping, industrial rolls and component parts for hydraulic cylinder assemblies and industrial machinery.

### 8 ARCHITECTURAL ANODIZED ALUMINUM GRATING

**Kiemp Metal Grating Corp.**—This special aluminum foil brochure describes the company's newest product, "Anotec", an architectural anodized aluminum grating. Its uses include sun deflectors or shades, decorative wall panels, spandrels, column facings, window guards, room-dividers, and patio screens. Its colors include clear anodized, gold, blue, copper, pink, green, and black.

### 9 ARCHITECTURE, CONSTRUCTION AND ENGINEERING

**F. W. Dodge Corp.**—A new 24-page catalog describing 43 books on architecture, construction and engineering is available. It includes a number of books especially recommended for civil engineers.

### 10 ASPHALT LINER MANUAL

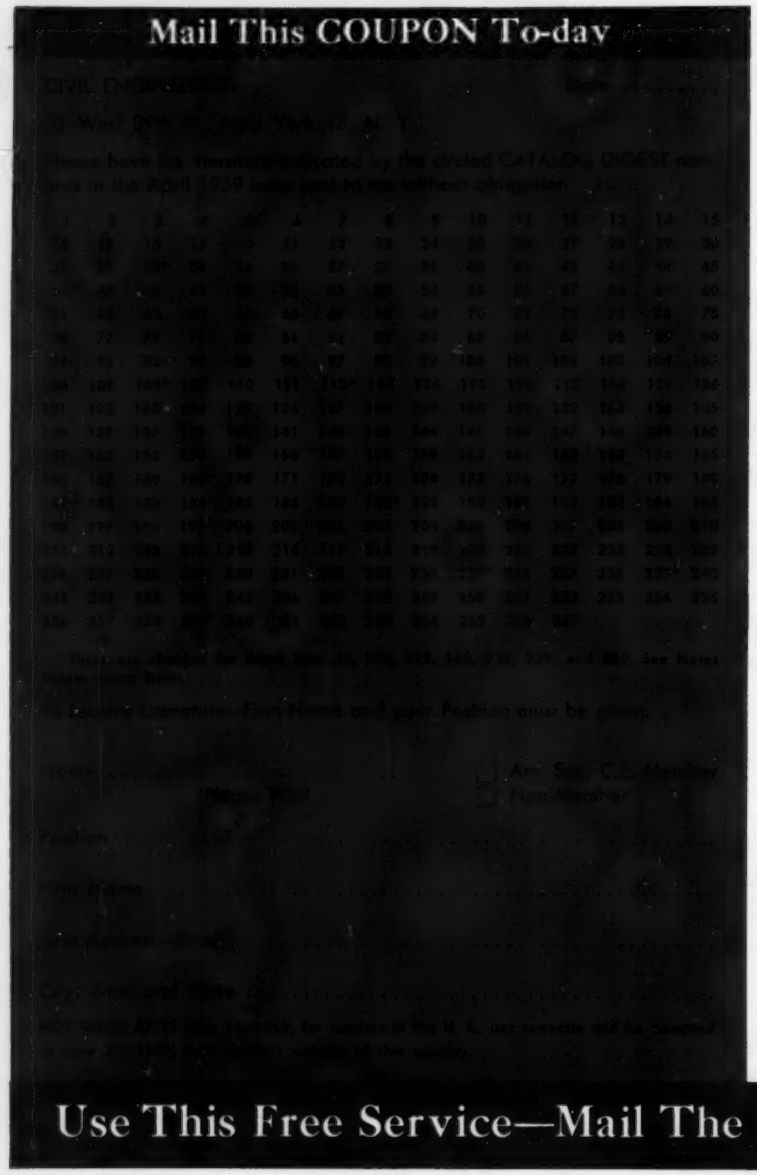
**W. R. Meadows, Inc.**—announces the availability of a "Hydromat" Asphalt Liner Manual. The "Hydromat" Manual fully describes applications and contains installation information, necessary technical engineering data and specification information. This is not a sales catalog, but strictly a Technical Data Manual.

### 11 ASPHALT PLANT INSPECTOR'S MANUAL

**The Asphalt Institute**—Available now for the first time is a manual for the asphalt plant inspector. The 160-page illustrated manual, in handy pocket size, contains a full discussion of the plant inspector's responsibilities together with detailed descriptions of both continuous- and batch-mix plants. Appended to the text are tables and forms, test methods, and a wealth of supplementary information for the inspector.

### 12 ATTACHMENTS AND ACCESSORIES

**Allis-Chalmers Mfg. Co.**—"Special Equipment for Allis-Chalmers Crawler Tractors and for Allis-Chalmers Motor Graders" is a 12-page, 2-color catalog (MS-1189). The attachments and accessories which are pictured and explained include pusher plates, various type track shoes, and truck wheel guards.


Use This Free Service—Mail The Coupon To-day

## CATALOG DIGESTS

### 13 AUTOCOLLIMATING THEODOLITE

**Kern Instruments, Inc.**—Information is available on the Autocollimation Eyepiece, which when attached to the DKM2 1-sec Theodolite, becomes an integral part of the instrument. Total telescope magnification is 23x, working distance up to 100 ft indoors. The light source is an easily replaceable standard 3-V or 6-V bulb. The instrument can be used for normal surveying without removing the eyepiece by simply switching off the light which illuminates the reticule.

### 14 AUTOMATIC GATES

**Thompson Pipe & Steel Co.**—This catalog illustrates and explains 3 devices which control upstream and downstream water levels and flow without usual floats and supervision. On-the-job photos and diagrams show the many irrigation and water-works applications. These gates are made on the widely-adapted Neyrpic principle.

### 15 BEARING PADS

**Voss**—An illustrated catalog concerning molded Neosorb and pre-formed Sorbtex bearing pads is now available. Especially suited for pre-stressed concrete or steel construction, they give full beam conformation and assure pre-calculated permanent set with limited deflection.

### 16 BOILER AND STOKERS

**The James Leffel & Company**—Complete descriptive and specification information on rugged Scotch boilers for gas, oil and coal firing and automatic underfeed stokers for Scotch type boilers is given in a 28-page bulletin 236. This richly illustrated brochure includes test results, performance data, and complete details of design and construction.

### 17 BOWSTRING TRUSS DESIGN MANUAL

**Macomber Inc.**—A catalog is available containing structural cross sections of mill type framing with drawings to scale of eave, roof and wall conditions, including crane runways, leantos, column connections and typical framing plans. Details show all conditions of both masonry and steel siding with complete bracing details.

### 18 BRIDGE FLOORING

**American Bridge Division**—This 32-page booklet contains complete engineering drawings and design data for all available I-Beam-Lok sizes, plus detailed coverage of Specifications, including the type of steel, erection, fabrication, painting, field assembly and welding. A brief discussion of composite T-beam action between I-Beam-Lok flooring and steel stringers is also included.

### 19 BUILDING SAVERS

**L. Sonneborn Sons, Inc.**—A 16-page brochure of building construction and maintenance data covering the company's water-proofings, floor treatments, admixtures and protective coatings. The product descriptions include definitions, directions, advantages, coverage and specifications. Known as Building Savers, these quality products are the tested solutions to your building construction and maintenance problems.

*Please give your complete address.*

### 20 BUTTERFLY VALVES

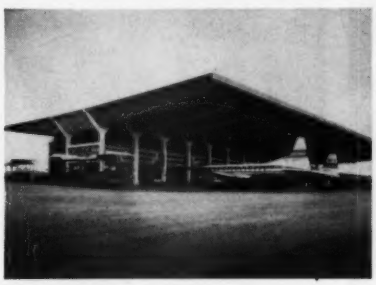
**B-I-F Industries, Inc.**—A new two-color bulletin describing the extended line of Class 125 Butterfly Valves is available. The brochure contains detailed information, cutaway drawings and photographs of the higher pressure butterfly valves, plus installation photos and information on choice of valve operators. Also included are dimensional data and cross sectional drawings of the valves designed for line sizes ranging from 4 in. to 48 in.

Architect: Weed, Russell, Johnson and Associates,
Engineer: Norman J. Dignum & Associates,
Contractor: Bradford Builders, Inc.; Miami, Florida.

# Vibroflotation®

## was used to compact the sandy subsoil at two National Airlines Buildings.

At Miami International Airport, the nose hangar and administration building of National Airlines are built on sand compacted by Vibroflotation.



Architect:
Weed, Russell, Johnson and Associates,

Contractor:
Fred Howland, Inc.; Miami, Florida.

Consulting Engineer:
Ammann & Whitney,

Soil Consultant:
D. M. Burmister; New York.

On two separate contracts, over 829 compactions were made to specified depth of 10 feet. Vibroflotation provided a rapid, effective, economical solution to the problem of eliminating foundation settlement.

Around this immediate area are several other buildings built on sand compacted by Vibroflotation including: American Airmotive Corporation's cantilevered hangar and Skyways Motel.

*Write for Booklet C-19*

**Proven Applications**

Deep Foundations • Dams
Bridges • Airports • Tunnels
Commercial Foundations
Industrial Foundations

**VIBROFLOTATION FOUNDATION CO.**
930 Fort Duquesne Boulevard
Pittsburgh 22, Pa.
ATlantic 1-2500

# CATALOG DIGESTS

### 21 CARPULLERS

**Superior-Lidgerwood-Mundy Corp.**—A 24-page, 2-color bulletin C-616 "Carpullers for Easy Moving Rolling Loads" is available, with descriptions, illustrations, data, tables, and specifications for Carpuller requirements. Illustrates and describes the Electric Capstan Carpuller for car moving, barge moving, pipe bending or any haulage of similar nature; also Tugmore Capstans, Horizontal Head type Capstan Carpullers, Drum Type Carpullers, Friction Drum Type Carpullers, etc.

### 22 CAST-IN-PLACE PILING

**Intrusion-Prepakt, Inc.**—Newly issued 20-page illustrated special report, No. 102, announces the company's expanded range of Cast-in-Place piling service. Also featured is the company's newest development, the post-tensioned Locked-in-place pile. Technical section explores new theories on methods of determining bearing capacities.

### 23 CAST IRON PIPE

**U. S. Pipe & Foundry Co.**—An 8-page booklet on centrifugally cast, Tyton Joint pipe for water or other liquids. The newly developed Tyton Joint is simple, sturdy, and tight. Illustrations show details of joint and method of assembly.

### 24 CAST IRON PIPE, HYDRANTS AND VALVES

**R. D. Wood Company**—A general catalog is available providing full details of weights and dimensions of "sand spun" cast iron pipe and cast iron fittings. This catalog also features fire hydrants, gate valves and other products manufactured by this company.

### 25 CERAMIC VENEER GRILLES

**Federal Seaboard Terra Cotta Corp.**—According to this new bulletin, the important role in architecture today is due in large part to the vast selection of colors it provides the architect. Now, this same freedom of color choice is available in Ceramic Veneer grilles. Eight standard grille designs are offered in ceramic colors. In addition, the company will custom-make Ceramic Veneer grilles of the architect's own design at a cost slightly higher than that for the standard units. Ceramic Veneer grilles permit the architect to design with color in mind when creating solar screens or perforated facades for sun control, ventilation, or to insure privacy.

### 26 CHAIN LINK FENCING

**Aluminum Company of America**—A six-page fold-out brochure of suggested standard specifications for aluminum chain link fence is now available. It contains complete description of fabric, fasteners, braces, posts, rails, and post tops, and it suggests specifications for alloys, with alloy designation of ASTM. Typical details of components are also pictured.

### 27 CHAIN LINK FENCING

**Aluminum Company of America**—A 16-page booklet outlining the many advantages of aluminum chain link fencing in the highway, industrial and municipal and public agency markets has been published. Text material is relatively brief and the brochure contains many illustrations of actual applications of aluminum fencing. In addition, tabular data and charts based on published ASTM test results are included to document the performance of aluminum fencing in various industrial and sea coast atmospheres.

### 28 CHEM-BREAK

**Lee, Revere and Van Buren Chemical Co.**—A chemical for softening concrete prior to and during breaking or removal for use with an air hammer, or other mechanical tool is discussed in this sheet. Called "Chem-Break", this is a powder which mixes with water to react chemically with the concrete, producing a more friable material, saving time on the job.

### 29 CHEMICALS FOR CONCRETE

**Sika Chemical Corp.**—Some of the products described in this 8-page catalog include Plastiment retarding densifier for increased strengths and improved workability; Igas Joint Sealers for long lasting, water-tight construction joints; Rugasol for exposing aggregates for construction joints or architectural effects; quick setting products for stopping leakage; and membranes and coatings. Numerous other products for use in all phases of concrete construction are also listed.

### 30 CLAD STEEL BRIDGE BEARING PLATES

**Lukens Steel Company**—A discussion of the development of Lukens clad steel for bridge bearing plate applications together with a description of types of plates presently available.

### 31 CLAD STEEL EQUIPMENT

**Lukens Steel Company**—A description of the development and manufacture of Lukens clad steels including data on types of cladding, cladding thicknesses, testing, clad steel heads, fabricating clad steel and various clad steel applications.


POSEY STEEL FORMS

- Telescoping and Non-Telescoping Forms For Tunnels, Sewers and Conduits
- Air Locks and Lock Doors For Concrete Bulkheads
- Jumbos for Drilling, Timbering and Concreting
- Head Frames, Cages, Special Muck Cars, Self-Dumping Skips, and Muck Bins
- Special Equipment For Underground Construction

We have the engineering experience and production facilities to handle all of your requirements for fabricated steel tunnel forms. For every job, big or small, Posey gets the work out as and when promised. Write, wire or phone without any obligation.

POSEY IRON WORKS, Inc.
*Tunnel and Mine Equipment Division*
LANCASTER, PENNSYLVANIA
*New York Office: Graybar Building*

DIVISIONS: STEEL PLATE FABRICATION • GRAY IRON AND STEEL FOUNDRY • BRICK MACHINERY AND MIXERS • INDUSTRIAL HEATING • IROQUOIS ASPHALT PLANT • TUNNEL AND MINE EQUIPMENT

# Only CONCRETE roads automatically provide

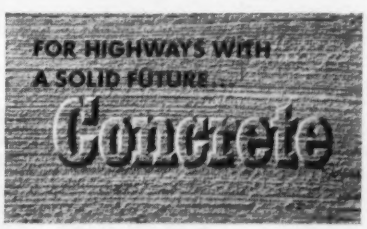
## 100% added strength for lasting load-bearing ability!

**Laid flat, concrete stays flat. Traffic rides smooth and steady . . . travels fast and far.** Modern concrete is the *engineered* pavement . . . designed mathematically to specific wheel load requirements. When you work to accepted design practice, you get a pavement that can support twice the rated axle load . . . a 100% margin of strength.

That's why concrete will stand up not only to rated axle loads in *normal* volume, but even in *peak* volume, with such loads running bumper to bumper . . . and last an expected 50 years and more. Reserve strength like that saves taxes and complaints. It's a big reason why upkeep costs will run as much as 60% lower than for flexible pavement.

Concrete often saves money in other ways, too. For example, on the Indiana Toll Road, engineers drew up designs for both types of pavement, proved concrete would save $9,740,000.

And truckers are the experts who can tell you that today's concrete means gentle treatment of cargoes. It's the flattest, smoothest-riding pavement there is. Small wonder concrete is the preferred pavement for the Interstate System and other heavy-duty highways.




**PORTLAND CEMENT ASSOCIATION**

*A national organization to improve and extend the uses of concrete*

### 32 CLAY PIPE

**National Clay Pipe Manufacturers, Inc.**—This 48-page fully illustrated brochure entitled "The Story of Clay Pipe" contains an historical record of clay pipe, its contribution to America from the beginning of the 20th century to the present, and a look into the future of American homes, industries and communities.

### 33 COFFERDAMS

**Spencer, White & Prentis, Inc.**—"Cofferdams," by Lazarus White and Edmund Astley Prentis is a trusted source-book covering actual design and construction of cofferdams as well as the theoretical features. The price is $10.

N. B. There is a charge for this book. Make checks payable to Spencer, White & Prentis, Inc.

### 34 COLD PATCHING

**The Texas Co.**—Detailed instructions on how to repair roads and streets by the Cold Patch Method are given in a pocket-size, 24-page booklet. Photographs illustrate proper procedure to be followed. Tables give recommended quantities of asphaltic material and aggregates to be used.

# Pulling RABBITS out of a HAT

It is obvious that water rates should be sufficient to finance maintenance, operations and necessary new construction. But water rates in America have been too low for over 75 years. The average paid by American water consumers for all water used is a little over 2 cents per day or 5 cents per ton. Water is the cheapest necessity you buy.

There are now many water distribution systems too small to supply peak demands of the growing communities they service, because they have been unable to finance new construction out of revenue. With a 65 to 70% potential increase in water consumption now predicted by 1975, the problem daily becomes more serious and water works improvements and extensions are needed on an increasing scale.

A magician may really appear to pull a rabbit out of his hat. But you can not expect your water works Superintendent to secure in that manner increased water supply, treatment, and distribution. To serve you better, he needs your help.

*This Series is an attempt to put into words some appreciation of the water works men of the United States.*

**M&H VALVE**
**AND FITTINGS COMPANY**
ANNISTON, ALABAMA
SUBSIDIARY OF WALWORTH


### 35 COMBINATION GRADER AND VIBRATORY COMPACTOR

**Galion Iron Works & Mfg. Co.**—Leaflet No. 424 describes how you can grade and compact with one machine. This unit is a combination of the Galion Model 503 Motor Grader and a Jackson Electric Vibratory Compactor. This combination will meet most density specifications for granular soil normally used for base and subbase construction.

### 36 COMMERCIAL FORMING APPLICATIONS

**Gates & Sons, Inc.**—Not intended to be all inclusive, this booklet contains typical examples of Gates Systems used for Commercial Forming as well as adaptations made for different forming specifications. Regardless of the type of forming required, the use of Gates Systems results in smooth, even walls at the lowest initial investment—and with a tremendous saving in time, labor and materials, the brochure states.

### 37 COMPACTION METHODS BOOKLET

**The Galion Iron Works & Mfg. Co.**—An informative, well-illustrated, non-technical, 16-page pamphlet covering all types of rollers and other compaction equipment has been published. This treatise will be especially helpful to anyone who has previously had no opportunity to study the subject of soils and materials compaction, the problems encountered, and the application of the various types of equipment available.

### 38 COMPLETE FABRICATION FACILITIES

**Washington Aluminum Co., Inc.**—This catalog shows the many unusual aluminum fabrications for industry. Among the fabrication assignments have been: water and sewage equipment, rigid and suspension bridges, tanks, hoppers, structures for loading platforms, buildings, cranes, and special applications. The company also offers assistance in resolving aluminum fabrication problems for industrial use, at no obligation.

### 39 CONCRETE BATCHING PLANTS

**L. O. Gregory Mfg. Co., Inc.**—This profusely illustrated 24-page Catalog includes detailed Engineering Specifications for Gregco Standard bins, batchers, and silos; also the new 3½-yd and 6-yd mobile batchers and complete Standard plants from 45 to 250-ton capacity.

### 40 CONCRETE BUCKETS

**Gar-Bro Manufacturing Co.**—Some of the types of buckets described in Bulletin 110 are: laydown buckets of the vertical discharge type for critical concrete and the extended gate type for placing concrete in sidewalls; round buckets for the building contractor; and concrete buckets for the general contractor. Features, photographs and specifications are included in this brochure.

### 41 CONCRETE FORMING SYSTEM

**Economy Forms Corporation**—A catalog with pictures is offered showing a complete forming system available to contractors on a purchase basis. The easy adaptability of these forms to all types of form work, plus engineering layout service on each new project, together with a complete steel form good for a lifetime of service makes the new EFCO form an attractive investment for the large and small builder. Also available, a four-page leaflet covering forms for prestressed or precast concrete beams, etc.

### 42 CONCRETE HANDLING EQUIPMENT

**Gar-Bro Manufacturing Co.**—A newly revised and profusely illustrated 36-page catalog 300A, containing specifications for more than 300 items of concrete handling equipment is available. Serving as a job conditions and specifications guide, it features concrete buckets, chutes and hoppers, bucket attachments, powered crane hooks, carts, wheelbarrows, bins and batchers, paving vibrators, industrial wheels and other equipment.

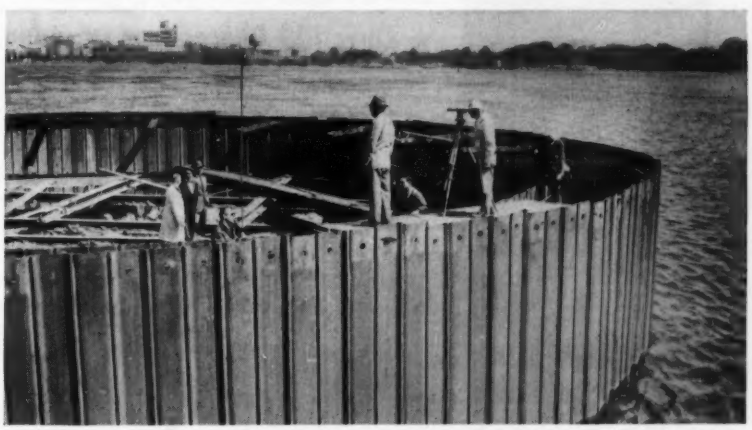
This long-range view shows island and tower in the Niagara River.

# Man-made island of steel piling

An artificial island of steel and concrete now dots the Niagara River about one mile above Niagara Falls. The 85-ft-diam structure consists of a double wall of Bethlehem steel sheet-piling, with concrete poured between the walls to form the island's perimeter.

The project is one part of the tremendous expansion of power facilities now being carried out by Niagara Mohawk Power Corp. in the upper New York State area. A 264-ft tower, erected on the island, will carry a high-voltage line joining the company's Huntley steam-electric station to the Falls.

Bethlehem produces a complete line of both sheet-piling and H-piles. If you would like copies of our illustrated catalogs on both these products, call the nearest Bethlehem sales office, or write to us direct at Bethlehem, Pa.



Sheet-piling island walls under construction. *General Contractor:* Herbert F. Darling. *Marine Contractor:* Merritt-Chapman & Scott Corp.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

**BETHLEHEM STEEL**

BETHLEHEM STEEL

### 43 CONCRE PIPE COUPLING—AMBAND

**American-Marietta Company**—A pamphlet on Amband fiber glass reinforced resin couplings used with double spigot, rubber gasketed concrete pipe. To be used for pressure heads up to 150 feet, for infiltration as low as 50 inch-gallows per mile per day. Amband couplings withstand corrosive action.

### 44 CONCRETE PRECISION BUMP CUTTERS

**Concut Sales, Inc.**—A 2-page catalog illustrates and describes the concut precision bump cutter which quickly and efficiently eliminates bumps from concrete and asphalt surfaces within the tolerance of ⅛-in. deviation in 16-ft. It also develops varying degrees of surface texture by adjusting the width of the spacers between the diamond blades.

### 45 CONCRETE SAWING EQUIPMENT

**Concut Sales, Inc.**—A bulletin illustrates and describes the complete line of Concut Concrete Sawing Machines, Supreme Diamond Blades and Abrasive Blades. Included in the line is the Model R-85 Lightweight machine for sawing concrete up to 3-in. in depth, Model-S-200 Standard machine for sawing up to 5-in. in depth, the Self-Propelled Concut and the Jointmaster for large air base and highway sawing jobs.

### 46 CONCRETE TESTING EQUIPMENT

**Forney's Inc., Tester Div.**—The manufacturer offers a catalog describing a complete line of low cost plant and jobsite testing machines for cylinders, cubes, beams, blocks, pipe, tile and lintels. Data on Cylinder Capping Apparatus, Kelly Balls, Slump Cones, Cube Molds and other collateral apparatus is included.

### 47 CONCRETE VIBRATORS

**Dart Manufacturing & Sales Co.**—Complete details are available on the DHC-300 "Texan", a 43½-lb vibrator having a head length of 21 in. and a diameter of 4 in. Developed especially for continuous service on big jobs such as dams, aircraft runways, and launching pads —where pours are deep and aggregate is large, it operates on 180 cycle current and is available in either 115 or 230 volts. Information is also available on the L-10 Concrete Vibrator, the Model GM 3HP (electric model), and the Model 500 CW (gasoline model).

### 48 CONSTRUCTION & ENGINEERING FUNCTIONS

**Macco Corp.**—Offered free of charge is a descriptive brochure containing thumb-nail sketches of the functions o fthe company's diversified divisions an dsubsidiaries. Included are the Construction Division; Diversified Builders, Inc.; Pipeline Division; Lumber Division; Refinery & Chemical Division; Belyea Truck Co.; Pacific Crane & Rigging Co.; Pacific Dredging Co.; Rig Building Division; and the Drilling Fluid Division.

### 49 CONSTRUCTION DATA HANDBOOK

**A. C. Horn Companies**—A handbook has been published which will be of interest to architects, contractors, and engineers. This 160-page handbook contains 100 detailed specifications on the company's construction and maintenance products. It also includes 2 indexes and 30 construction tables.

### 50 CONSTRUCTION EQUIPMENT

**International Harvester Co.**—Some of the equipment listed in this pamphlet are: crawler tractors, blades, scrapers, payhauler, payscraper, skid-shovels, and sidebooms. Photographs and brief specifications are included.

### 51 CONTRACT PUMPING

**American Dewatering Corp.**—A well illustrated catalog describing the predraining of many construction projects of typical and unusual interest. Outlines the services and benefits of contract pumping in which this company specializes.

### 52 COST DATA

**Barco Manufacturing Company**—Of interest to earthmoving contractors is a bulletin of cost data for soil compaction in restricted areas. Specifications accompany the data.

### 53 CROSS SECTION REDUCER

**RBP Engineering**—The Operation Manual of the Rbp Cross Section Reducer is now being offered. The reducer can be used to replace a transit in cross section work, freeing an expensive transit for other work. Weighing approximately 8 lb, it has the advantage of being lighter and can be set up in a fraction of the time required for a regular transit. Illustrations are included.

### 54 CUTTING EDGES

**Caterpillar Tractor Co.**—Results of on-the-job comparative tests of Caterpillar scraper and dozer cutting edges are outlined in an 8-page two-color booklet. Entitled "Proof of the Difference," it carries written statements from Ohio, California and Kentucky firms telling of applications in which the edges proved their toughness. All processes of manufacture of the edges are shown pictorially, from the hot-rolling of medium-carbon steel, through heat treatment, design and quality control measures at the factory.

### 55 DATA AND SPECIFICATION MANUAL

**Klemp Metal Grating Corp.**—Contained in this 20-page booklet are tables of safe loads and deflections for welded rectangular steel gratings and riveted reticuline steel gratings. Also included are sections on the ordering of grating; drain grates, anchors; Hexteel and Floorsteel. Available also is a catalog entitled "Growth!", which is an 8-page study of the continuous application of Klemp Products in the Oil and Gas, Petroleum, Petrochemical, and Chemical Industries.

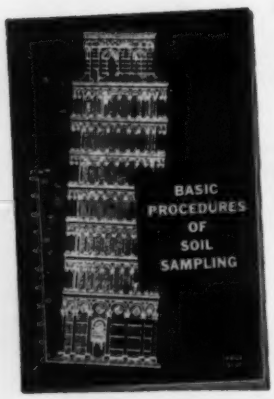
### 56 DENSION CORE BARREL

**Acker Drill Co., Inc.**—offers free of charge, a copy of Bulletin 1100, which describes the Dension Core Barrel. Acker has obtained exclusive manufacturing rights to the tool. The brochure illustrates and describes how the core barrel operates. The cutaway drawing of the barrel shows all of the important operational features.

### 57 DEPTHOMETER, CAMERA, LOCATOR

**Bludworth-Marine**—Literature describing the single transducer survey depthometer ES 130, which is portable, weighs under 40-lb and performs with great flexibility and precision, is available. Also provided is information on an underwater TV camera with a continuous picture on monitor screen on boat or land, with depths to 180-ft; and a metal locator which pinpoints ferrous and non-magnetic metals in fresh and salt water. Pressurized to depths up to 160-ft, this locator weighs 1½-lb submerged.


# NEW SOIL SAMPLING BOOK AVAILABLE!




★ 68 Pages ★ 16 Chapters
★ Over 100 Photos and Drawings

Here's a non-technical book that provides 68 illustrated pages of the latest methods, procedures and tools for sampling.

This is a "how to" book—an easy-to-follow guide for the builder, construction contractor, civil engineer or architect. If you need fundamental soil sampling information, this book is for you.

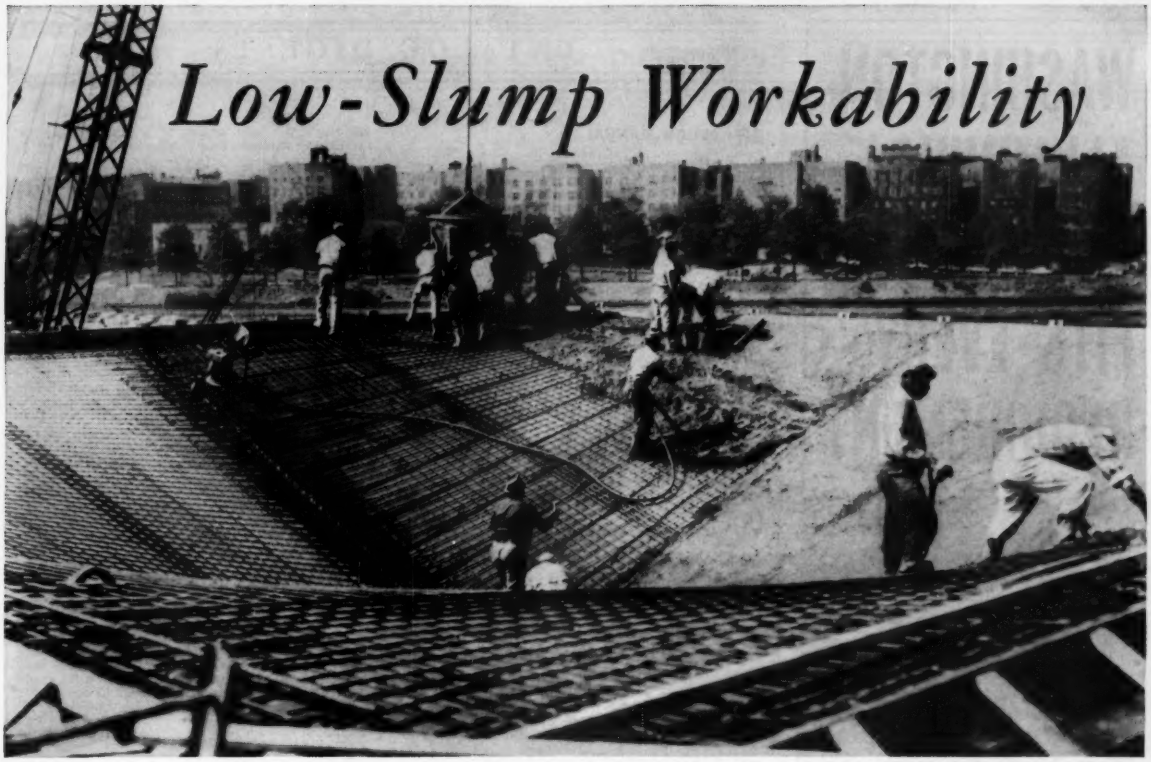
For only $1.00, a fraction of the preparation and printing costs, we'll rush you a postpaid copy of "Basic Procedures of Soil Sampling." If not completely satisfied, return the book within seven days, for full refund.

ACKER DRILL CO., INC. CE
P.O. Box 830 • Scranton, Penna.
Gentlemen:
Here's my check for $1.00. Rush me a copy of "Basic Procedures of Soil Sampling."
Name.....
Firm.....
Street.....
City.....State.....

ORDER YOUR COPY TODAY!

In filling out the coupon, please print clearly and be sure that you furnish a complete address.

# *Low-Slump Workability*



*This hyperbolic paraboloid, spanning 60 feet, is one of six for the new library of Hunter College, New York City.*

## ...with PLASTIMENT

Architect:
**MARCEL BREUER, FAIA**
Consultant: Eduardo Catalano
Associate: Robert F. Gatje
Consulting Structural Engineers:
**FELIX CANDELLA; FARKAS & BARRON**
General Contractor:
**LEON D. DeMATTEIS & SONS, INC.**
Concrete Contractor:
**DIC CONCRETE CORP.**

The problem, to place lightweight Lelite concrete on steep slopes — as much as 45° — for the 3½ in. thick hyperbolic paraboloid roof of the new Hunter College library . . . Good workability at low slumps and a cohesive mix were vital . . . Plastiment retarding densifier, added to the mix, gave the desired workability at 2-inch slumps, and rapid clear-water bleeding for stability on steep slopes, resulting in sound concrete . . . Strengths of 3000 psi were obtained in 7 days.

Plastiment controls the hydration of cement by retarding and reducing cement gel formation . . . It does not entrain air so that proportions can be varied to meet job conditions . . . Workability is greatly increased so that even stiff mixes are readily compacted . . . In addition, it reduces cracking, increases strength and provides more uniformity in a concrete member.

Call Sika direct or nearest distributor for catalog and technical information and service.

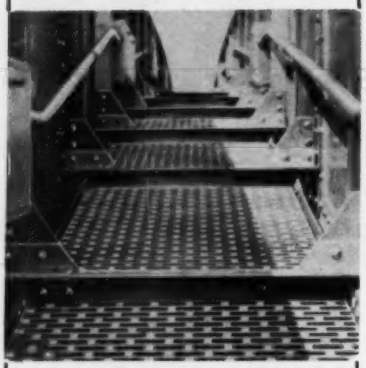
*Other Sika Admixtures:*

| SIKACRETE | SIKA AER | INTRAPLAST | SIKA NO. 1 |
|---|---|---|---|
| Accelerating Densifier | Air Entraining Resin Solution | Expanding Grouting Aid | Integral for Cement Mortar |

RELIABILITY • EXPERIENCE • SERVICE

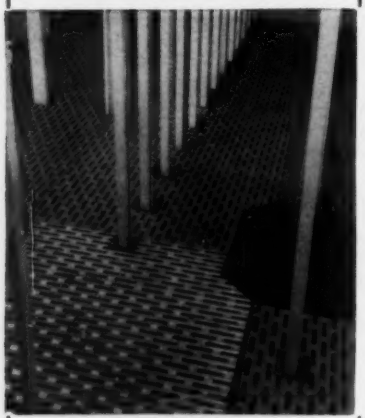
Sika
**SIKA CHEMICAL CORPORATION**
PASSAIC · NEW JERSEY
COMPOUNDS FOR MASONRY and CONCRETE CONSTRUCTION
DISTRICT OFFICES: ATLANTA • BOSTON • CHICAGO • DALLAS • DETROIT • NEW ORLEANS • PHILADELPHIA
PITTSBURGH • SALT LAKE CITY — DEALERS IN PRINCIPAL CITIES — AFFILIATES AROUND THE WORLD

# WASHINGTON ALUMINUM GRATING FITS EVERY REQUIREMENT



**WALKWAYS & RAMPS**

Exclusive I-Beam Design rivals structural strength of steel at fraction of weight. Can be fabricated to support any weight load; to any length, width or shape.



**FLOORING & PIT COVERS**

Patented upset design provides non-skid all direction safety under wet, greasy, other hazardous conditions. Maintenance-free, non-magnetic, non-sparking.

*SEND FOR FREE BROCHURE*

**WASHINGTON ALUMINUM COMPANY, INC. DEPT. 324**
**Baltimore 29, Maryland**


# CATALOG DIGESTS

## 58 DESIGN MANUAL

**W. R. Meadows, Inc.**—has prepared a manual entitled "Design Techniques for Controlling Moisture in Building Structures." This manual, prepared by a firm of technical engineering writers, was originally planned to sell for $1.00 per copy. However, as this problem is of vital interest to all in the construction industry, this company will now send a free copy to all architects, engineers and builders who desire a copy for their file.

## 59 DIGITAL COMPUTER

**Bendix Aviation Corp., Bendix Computer Div.**—An illustrated bulletin on the G-15 general purpose digital computer is available. Featured is a full description of the simplified programming of this low-cost machine, which places it among the easiest computers to use. Engineers can be taught coding techniques within 2 to 4 hours. Specifications, accessory equipment and applications are also described.

## 60 DIRECT READING LEVEL ROD

**Lenker Manufacturing Co.**—The brochure describes and illustrates the new approach to the accurate and rapid method of reading elevations on the rod direct. When the graduations, which are numbered downward on the movable steel band, are set to the elevation of the bench mark, all readings are elevations. One column is required to record the elevations in the note book.

## 61 D-O AERATOR

**Dorr-Oliver Inc.**—A new 4-page, two-color bulletin entitled, "The D-O Aerator", describes the development, design and advantages of this improved method for supplying oxygen demands in the activated sludge process. Also included in Bulletin No. 7316 are cutaway wash drawings of typical Aerator installations and activated sludge flowsheet in which the unit is employed.

## 62 DOCKS, WHARVES AND MOBILE DRILL BARGES

**DeLong Corporation**—A 20-page, profusely illustrated booklet describes the DeLong method of installation of prefabricated docks, wharves and other structures including mobile offshore drill platforms raised by means of the DeLong Jack. Also describes the famous Texas Tower project, a mobile aerial cableway system and other commercial and military installations.

## 63 DORRCLONE DESANDING SYSTEM

**Dorr-Oliver Inc.**—The availability of a new 4-page, two-color brochure entitled, "The DorrClone Desanding System", has been announced. This brochure describes the design, operation and performance of the new system for desanding water supplies. Also included in Bulletin No. 2507 are an installation photograph, schematic flowsheet of the system, cutaway wash drawing of the DorrClone classifier and operating data.

## 64 DRAFTING PENCIL

**J. S. Staedtler, Inc.**—The leaflet "Won't Smear on Mylar!" gives information on Mars Duralar, the new drafting pencil especially developed for work on the new matte-surface Mylar tracing films. It will not smear, keeps its point, erases cleanly, reproduces perfectly. Drawings can be cleaned with soap and water, and microfilm without loss of detail. Duralar is available in 5 special new degrees of hardness (K1 to K5) in pencils, leads; Duralar lead holder is also available.

## 65 DRAIN GRATES

**Irving Subway Grating Co., Inc.**—A four-page, two-color folder illustrating the use of open mesh steel flooring as drain grates is available. The folder contains photographic illustrations and shows typical uses of drain grates. There are engineering drawings of the various types and complete technical data to facilitate estimates and specifications.

## 66 DREDGING EQUIPMENT

**Posey Iron Works, Inc.**—This catalog contains photographs of drag heads, combination wye branch and gate valve, fabricated spuds, pontoon and shore pipe, pressed steel plate ball joints with abrasion resisting steel plate liners, and hydraulic dredge hull. The company offers a complete selection of pipe and other dredge fittings to meet every dredging need. All units that are subject to abrasion are fabricated from high carbon—high manganese special dredge pipe steel or abrasion resisting steel.

## 67 EARTH TAMPERS

**Jay Co.**—Catalog JT 333 contains descriptive material on all three sizes of earth tampers "at work". It gives basic sizes, travel speed ranges and impact ratios of complete line including the new J-18 which will deliver three times more compaction than the famous J-12 tamper.

## 68 ELECTRONIC COMPUTING SERVICE

**Statistical Tabulating Corp.**—Computer service bulletin describes a special low-cost service offering engineers time and money savings on design and development calculations through the electronic digital computer. Literature also covers the company's library of "packaged" programs available to clients without cost.

## 69 ELEVATED TANKS

**Pittsburgh-Des Moines Steel Co.**—Details of the several different types of elevated steel tanks, including capacity, ranges, tank dimensions, and other factors to be considered in the selection of storage tanks. Also available, 4 pages of pictures and discussion about flat bottom water storage.

## 70 ELLIPTICAL CONCRETE PIPE

**United States Concrete Pipe Co.**—Some of the features of elliptical concrete pipe contained in this 4-page brochure are: lower excavation cost, less headroom required, and greater flow capacity. Also included in this booklet are dimensions and elliptical pipe flow data.

## 71 ELLIPTICAL CONCRETE PIPE—LO-HED

**American-Marietta Co.**—This pamphlet covers elliptical Lo-Hed Reinforced Concrete Pipe for culverts and sewers. Specifications are given for the complete range of sizes from the equivalents of round pipe 18-in. I. D. through 144-in. I. D. Illustrations show results of pressure tests and installations of Lo-Hed pipe being made on various types of jobs.

## 72 ENGINEERING VIBRATOR GUIDE

**Dart Manufacturing & Sales Co.**—To help contractors determine the proper type of concrete vibrator for use on specific jobs, the company has made available an Engineering Vibrator Guide questionnaire. Contractors may fill in on this single sheet the type of job, size of aggregate, volume of dump, total cubic yards, slump requirements and a variety of other facts along with a rough sketch or diagram of their job. The Dart engineering department will write their recommendations on the opposite side and return the data to the contractor without charge.

## 73 ENGINE RECONDITIONING

**Caterpillar Tractor Co.**—What is the proper way of obtaining positive initial valve seating when reconditioning a Diesel engine? What is the maximum clearance allowable between a remachined top groove and a new "wide" top piston ring? What is the maximum diameter wear limit for a cylinder liner before it must be replaced? These questions and others are answered in a new 8-page booklet, "Money Saving Hints on Engine Reconditioning." Tips on various operations which are necessary in reconditioning engines are also offered in the brochure.

### 74 ENGINES & POWER UNITS

**International Harvester Co.**—Some of the power features listed in this pamphlet for the V-8 carbureted model are: downdraft carburetion for maximum power with minimum fuel consumption; fully machined combustion chambers for equal high compression in all cylinders. The 4- and 6-cylinder diesels have dependable all-weather starting; long-life, full-pressure lubrication; and precision fuel injection system. Each engine is pictured and its specifications given.

### 75 EXCAVATORS AND TRUCK CRANES

**Harnischfeger Corp.**—A brochure is available which gives features and photographs of P & H Power Excavators and heavy-duty Truck Cranes. Some of the features of the ½ yd 155A Excavator include large clutch and brake areas readily accessible for quick, easy adjustment, independent planetary boom hoist as standard equipment, and 4-speed transmission for fitting the speed to the job. The 10-ton 55A-TC Miti-Mite Truck Crane has a twin swing assembly for fast, smooth swings, extra large tapered drums for maximum capacity and smoother cable spooling, and one-piece weaveproof carrier frame which eliminates sway at the boom point.

### 76 EXPANDED METAL PARTITIONING

**The Globe Co.**—This catalog describes Safe-Gard, new expanded metal partition panels with exclusive Quick-Erect patented fittings for easy method of guarding conveyors, machines and for all in-plant partitions. It gives complete range of sizes and all engineering data.

### 77 EXPOSED CONCRETE AGGREGATE

**Sika Chemical Corp.**—This 4-page brochure describes two ways of obtaining exposed concrete aggregate during construction. This exposed aggregate can serve as a bonding surface at construction joints or have a decorative architectural effect. On horizontal surfaces, Rugasol-C, Retardant Concrete Coating is applied directly on the freshly placed concrete. On vertical surfaces, or precast panels, Rugasol-F, Retardant Form Coating, is applied on the forms before or after erection.

### 78 FABRICATED PIPE & PILING STEEL

**Posey Iron Works, Inc.**—This 15-page catalog contains in-ship and field installation photographs, which are typical of the wide variety of jobs fabricated by the company. A few of the illustrations included are: car of pipe leaving plant, driving 30-in. OD Piles for bridge piers, special steel fabrication for oil refinery, and special fitting of stainless steel.

### 79 FABRICATED STEEL PRODUCTS

**United Steel Fabricators, Inc.**—Complete details, specifications and engineering data are available on highway guard rails, bridge flooring, corrugated metal pipe, rental buildings, and leave-in-place steel forms for concrete bridge decks.

### 80 FABRICATION & ERECTION

**Graver Tank & Mfg. Co.**—Of interest to engineers is the latest issue of Graver's employee magazine, which describes and illustrates a sampling of the broad range of projects utilizing the company's services in fabrication and erection of steel, clad and alloy plate. This issue includes articles on tanks and spheres for a refinery, stainless tanks for caustic, all-welded propeller pump pipes for flood control, underground fuel oil tanks, a pulp mill water tank and other features.

### 81 FIBRE FORMS

**Sonoco Products Co.**—Uses of Sonotube, fibre forms, are illustrated in a brochure. These fibre forms provide an economical method of forming round, obround, half-round and quarter-round columns. Also encasement of steel and wooden piles, existing columns and utility risers. Available in several different types, the newest which provides a form surface requiring little or no rubbing of the finished column. Technical data also available.

### 82 FIBRE TUBES

**Sonoco Products Co.**—Sonovoid, fibre tubes, were specifically developed to form voids in bridge decks; wall, floor, roof and lift slabs and in concrete piles. Uses illustrated in a brochure. Sonovoid, fibre tubes, are used in precast or cast-in-place units of conventional or pretensioned construction. Tie down and spacer method shown along with design data for 8-in. and 12-in. slabs. Other technical data available.

### 83 FIELD EQUIPMENT

**Warren-Knight**—Part 1 of two brochures concerning Engineering Equipment & Supplies, has been published. Entitled "Field Equipment" this booklet includes write-ups and photographs on transits and levels, compasses, measuring tapes, spring joint rules and survey markers. Paragraphs concerning instrument care and repair are included in this 24-page booklet.

### 84 FILM OFFERED

**Layne & Bowler, Inc.**—Entitled "Deep Waters", this full color, sound 16-mm motion picture film on ground water development portrays how water reaches the underground formations with animated sequences of underground processes which could not be photographed; and how water is located and the processes necessary for its production in ample quantities. The picture runs 22 minutes and is available to interested groups for showing without cost.

### 85 FILTER MEDIA

**Anthracite Equipment Corp.**—A bulletin on "Anthrafilt" tells the reasons why selected, graded crushed anthracite is superior to sand as a filtering material. Information about a free technical advisory service is included.

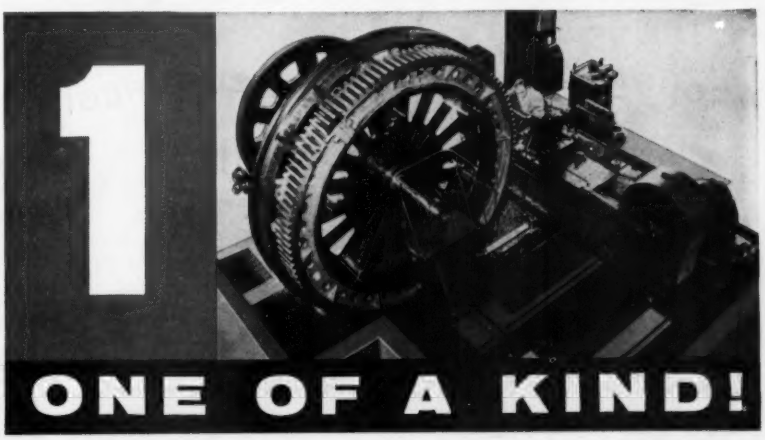
### 86 FILTERS, EVAPORATORS AND PROCESS EQUIPMENT

**Goslin-Birmingham Mfg. Co., Inc.**—This loose-leaf general product catalog contains information on filters, evaporators, process equipment and contract manufacturing. Illustrations and specifications are included.

### 87 FLIGHT SIMULATOR

**Bendix Aviation Corp., Bendix Computer Div.**—A description of the 3-Dimensional Flight Simulator and its applications are explained in a 24-page illustrated bulletin. The expense of testing missiles, aircraft navigational systems and associated components can be materially reduced through the use of the Simulator which is comprised of a 3-axis flight table and a complementing analog computer. Control with this system reduces or eliminates the need for expensive trial flights in "debugging" airborne systems.

PLEASE BE PATIENT
YOUR REQUESTS TAKE TIME


This specially designed versatile, internal-external **PRECISION** spur gear cutter is the only one of its type and range in modern industry . . . Cuts any desired pitch or tooth form . . . Max. O.D. 22', Max. I.D. 12' . . . It has cut giant gears for use in Kilns, Crushers, Sugar Mills, Cement Mills, Rotary Dryers & Power Shovels.

THE TOUGH JOBS GO TO EARLE

- SPECIAL MECHANISMS
- SPEED REDUCERS
- SPROCKETS
- SHEAVES

THE EARLE GEAR & MACHINE CO.
4707 STENTON AVENUE
PHILADELPHIA 44, PA.

Earle Gear & Machine Co.
Gentlemen:
☐ Please send me your catalog on operating mechanisms . .
☐ Please contact me about . . .
Name_____
Address_____
City_____

### 88 FLOOR ARMOR

**Irving Subway Grating Co., Inc.**—A 24-page color catalog on Gridsteel floor armor. Gridsteel is made of steel bars on edge, bent and joined together in a continuous hexagonal mesh pattern. Floors armored with Gridsteel last indefinitely. Gridsteel prevents ruts or potholes from forming, gives an even, tractional floor surface at all times. Catalog illustrates uses, advantages, and shows how quickly and simply Gridsteel is installed.

### 89 FOUNDATION CAISSONS & PILES

**Franki Foundation Co.**—An interesting, informative and well illustrated brochure describes in detail the Franki method of installing Displacement Caissons and Pressure Injected Footings. Caisson load test results on representative projects and reinforced concrete cap design data are noted. Various types of pile foundations installed by Franki are indicated.

### 90 FOUNDATION PIPE

**L. B. Foster Co.**—Comprehensive information of spiralweld foundation pipe piles is presented in a 24-page booklet. In addition to detailed specifications, the photo-illustrated brochure describes a number of pipe pile installations and includes typical driving logs. A special feature is a table giving complete specifications of all popular pile hammers, including new diesels.

### 91 FOUNDATION PRODUCTS

**Armco Drainage & Metal Products, Inc.**—Catalog FP-13558 describes three basic types; pipe piles, caissons, and Hel-Cor pile shells. There are sections on where the products are used, and why; typical installations; field operations; and how to specify. Also included are tables on dimensions and weight, pile driving hammers, and data for computing pile bearing capacity.

### 92 GEAR DRIVE

**Johnson Gear & Mfg. Co.**—Right angle gear drives for vertical shaft pumps and industrial use such as sewage disposal, water supply, fire and flood control, cooling tower installations and barge service, are described and illustrated in catalog #29 and #30. Complete engineering details are also given.

### 93 GEARS

**The Earle Gear and Machinery Company**—A twenty-page catalog describes in general, the kinds and sizes of gears manufactured by this company. Its contents deal with spur gears, bevel gears, helical gears, worm gears, racks, non-metallic gears, sheaves, sprockets, special machinery of which gears form a part, and special gear information. Illustrated with photographs, it also shows actual Earle installations.

### 94 GENERAL PURPOSE COMPUTER

**Royal McBee Corp.**—Brochure S-526R1 gives specifications and basic features, illustrates major components and lists applications of the LGP-30 General Purpose Computer. It also describes the operation of the control panel and simple 16-part Command Table, and illustrates the new optional photo-electric punched tape Reader (200 characters per second), and combination high-speed Reader and Punch unit.

### 95 GISMO TRANSLOADER

**Sanford-Day Iron Works, Inc.**—This illustrated brochure describes the one-man operated self-loading and self-dumping transport called the Gismo Transloader, which shuttles back and forth between muck pile and the dumping point without the synchronization of several pieces of equipment or positioning of equipment to load. It keeps working full shift—loading, transporting and dumping in continuous, uninterrupted performance-cycles.

### 96 GRATING CATALOG

**The Globe Co.**—This 24-page grating catalog describes two products, Safety Grip Strut Grating, of one piece construction in steel, aluminum and stainless steel, and also the Gold Nugget welded grating which is projection welded for greater rigidity and strength. It shows installations, gives complete engineering data for erection, plus accurate load charts for both gratings; it is fully illustrated.

### 97 GRATING FLOORING AND TREADS

**Irving Subway Grating Co., Inc.**—General Grating Catalog F400 contains illustrations, descriptions and complete engineering data on full line of grating products made in steel, aluminum and other metals. Catalog shows riveted, welded and pressure-locked types for use as flooring, treads, walkways, trench covers, and so on. Irving grating is safe, durable, self-draining, ventilating, clean, fireproof, economical.

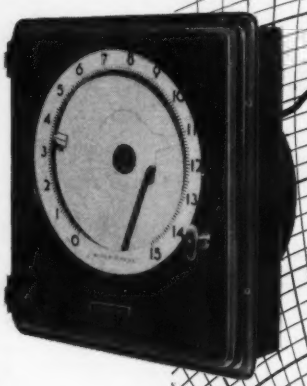
Turn to page 132 and order your literature.

ACCURATE GRAPHIC AND VISUAL REGISTRATION

of liquid flow with

STEVENS

RECORDER TYPE B-FT



Recording, indicating and totalizing meter for measuring sewage or other flows over Parshall flumes and weirs. This instrument has interchangeable flow cams and flow conversion gears... an important factor to consider for sewage treatment plants in rapidly growing communities. With a simple change of cams and gears the Type B-FT Recorder can operate with a different size flume or accommodate a greater range of flow than that for which it was originally purchased. The change does not require factory service. Similarly, change from weekly to daily time scale, or vice versa, is accomplished by merely repositioning one gear — no new parts to buy.

This recorder can be direct float operated or remotely controlled and is available for wall or switchboard mounting, or with cabinet for mounting out of doors directly over the float well. Request BULLETIN 25 for complete details.

STEVENS HYDROGRAPHIC DATA BOOK

Invaluable for your reference file. Contains technical data on recorder installations, plus a wealth of hydraulic and conversion tables. $1 copy. (No COD's)

STEVEN

O

DATE ____

TOTALIZER BEGIN

_____

LEUPOLD & STEVENS INSTRUMENTS, INC.

4445 N. E. GLISAN STREET · PORTLAND 13, OREGON

*Specialists in hydrologic instruments for over half a century.*

## CATALOG DIGESTS

### 98 GRATINGS

**Borden Metal Products Co.**—A 16-page catalog shows the three basic types of grating construction; more than 30 dimensional drawings of subtypes; eight safeload tables covering steel and aluminum gratings, roadway grating and sidewalk slabs plus other tables on panel widths, tread widths, floor armor, etc. Also shown are the various safety treads and their nosings. Included are the steps for careful planning and checking of the job.

### 99 GUNITE

**Pressure Concrete Co.**—Gunite in all phases is described and illustrated in a 48-page booklet which contains complete specifications. Illustrations show Gunite repair of reservoirs, dams, filter plants, sewage disposal plants, stadiums, bridges, stacks and bunkers. The booklet also contains photographs on prestressed tank construction and other data. A leaflet illustrates pressure grouting to dams.

### 100 HANDRAIL SYSTEM

**Universal Railing Co.**—A pamphlet is available which describes the Universal Handrail System, which cuts railing costs by eliminating the necessity for detail design, prefabrication, welding, templates, costly mistakes, and scrap materials resulting from errors. The fittings add fast delivery and installation, flexibility, streamlined appearance, a finished job, started and completed on site, and 100% salvage of fittings and pipe.

### 101 HEAVY DUTY TRAILERS

**Dorsey Trailers**—Information is available on the Model "MK" Low Bed Heavy Duty Trailers, which are available in 10 and 15 ton capacities in both semi and full trailers. These lightweight economical trailers with simple trouble-free construction afford exceedingly low cost transportation for equipment in the 10 and 15 ton classes.

### 102 HEAVY WALLED PRESSURE VESSELS

**Chicago Bridge & Iron Co.**—An illustrated, 8-page brochure describing the company's coordinated services for the design, fabrication and erection of heavy walled pressure vessels is available.

### 103 HIGH STRENGTH BOLTING

**Russell, Burdsall & Ward Bolt & Nut Co.**—A 20-page illustrated booklet giving the man on the job practical working information on high strength bolts has been published. Designed as a working guide for ironworkers in the fast-growing technique of joining structural steel members, the brochure explains the theory of bolting in A-B-C terms, and technical findings helpful to bolting crews and other men on the job are summarized in easily understandable form through use of photos and line drawings.

### 104 HIGH STRENGTH STEEL DESIGN MANUAL

**United States Steel**—The first complete text on how to design high strength low alloy steels. Concise, well-written, it covers unit stresses, beams and columns, plates, riveting and designing to thwart corrosion. Probably the only basic text extending design fundamentals to the higher strength levels of high strength steels.

### 105 HIGHWAY CONSTRUCTION

**American Steel & Wire Div., United States Steel Corp.**—Here, under one cover, is a description of the company's products for use in highways and streets. They include: Welded Wire Fabric, Multisafety Cable Highway Guard, Beam Guard, steel and wire products for Prestressed Concrete, steel and wire products for Reinforced Concrete Pipe, American Welded Wire Fabric for tunnel and bridge construction, and for bituminous concrete road repairs.

**BRUNSON TRANSITS**

go to extremes to prove **LASTING ACCURACY**

Only instruments of Brunson design could weather temperatures from −70° to +160°, withstand 350 days of punishing dust bombardment!

In severe tests and in years of the hardest field service, Brunson instruments have proved their lasting accuracy and operability under extreme conditions. The reason: Brunson's unique ball bearing construction!

Located in the spindle and telescope axis, Brunson ball bearings are permanently lubricated by an all-temperature lubricant and sealed against moisture and dust. Wear is practically eliminated. Preloaded and accurate to 5-millionths of an inch, these bearings provide highest possible instrument accuracy.

Brunson ball bearing construction costs you no more—offers much more in accurate, trouble-free performance. Why not mail the coupon, right now?

BRUNSON

*Distributed Exclusively By*

BRUNING

Charles Bruning Company, Inc., Dept. 4-CC
1800 Central Rd., Mount Prospect, Illinois
Offices in Principal U.S. Cities
In Canada: 105 Church St., Toronto 1, Ont.

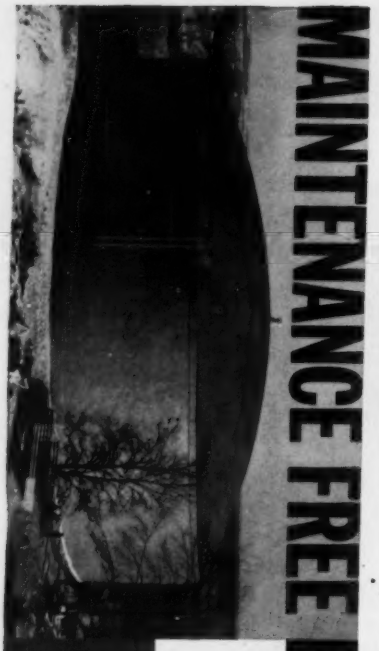
Please send me more information on Brunson surveying instruments.

Name_____ Title_____

Company_____

Address_____

City_____ County_____ State_____



MAINTENANCE FREE PRESTRESSED CONCRETE TANKS

- OVER 2000 TANKS IN SERVICE
- NO MAINTENANCE COST
- 75% CONSTRUCTION COST SPENT LOCALLY
- LOWEST OVERALL COST
- PROVEN IN SERVICE
- SATISFIED OWNERS

THE PRELOAD COMPANY, INC. 211 East 37th St., New York 16, N. Y.
351 Jefferson, Dallas, Texas • 711 Perimeter Road, Kansas City, Mo.

PRELOAD CONCRETE STRUCTURES INC. 437 Old Country Road Westbury, Long Island, New York

HERRICK IRON WORKS 28400 Clawiter Road Hayward, California

THE CANADA GUNITE COMPANY, LTD. 7325 Decarie Blvd. Montreal 16, Canada

If you have a water storage problem, call or write for Bulletin T-22.

PRELOAD


## CATALOG DIGESTS

### 106 HONEYFOAM INSULATION

**Servicised Products Corp.**—A new catalog describing Honeyfoam perimeter insulation provides detailed data on the new plastic-foam type of insulation. Complete with Heat Transmission Tables, Physical Properties, detailed installation drawings and clear application photographs, this literature in addition shows Honeyfoam Insulation board being used as an insulating-plaster base for interior-exterior walls and gives its specific bonding strength with Gypsum Plaster and Portland Cement Mortar.

### 107 HOT WEATHER CONCRETING

**Sika Chemical Corp.**—Complete information on controlling the set of concrete during hot weather is available. Test data, specifications and technical information on Plastiment Retarding Densifier are included.

### 108 HOW TO CORE DRILL

**Acker Drill Co., Inc.**—"Basic Procedures of Diamond and Shot Core Drilling" shows with over 80 illustrations and drawings the fundamentals of core drilling practice. Pipe driving, core recovery, core logging and storage are all covered in this pocket size book for the beginning driller. The price is $1.00.

N. B. There is a charge for this book. Make checks payable to Acker Drill Co., Inc.

### 109 HYDRAULIC TURBINES

**The James Leffel & Co.**—Details on the turbines which drive both power generation and pumping units at the United States Bureau of Reclamation, Chandler Power and Pumping Plant, are given in a 12-page Bulletin 1098-E. Descriptive literature on other recent turbine installations will be enclosed.

### 110 HYDROELECTRIC EQUIPMENT

**Yuba Consolidated Industries, Inc.**—Brochure #HY-51 shows the company's entire line of steel fabricated products for the hydroelectric and waterworks industries. Products described include gantry cranes, hoists, bridge cranes, structural fabrications, electrical structures, pit liners, spiral cases, draft tube gates, draft tubes, large valves, penstocks, trashracks, and intake gates.

### 111 HYDRO EQUIPMENT

**Pacific Coast Engineering Co.**—Information is available on the company's services to the power industry. A single source for all hydro hardware including cranes, hoists, gates, trash rakes, valves, draft tubes, conduits, penstocks and fittings, it can reduce initial costs because all parts can be coordinated in both design and fabrication, and it can maximize the operating efficiency of each unit.

### 112 HYDROGRAPHIC DATA BOOK

**Leupold & Stevens Instruments, Inc.**—This 120-page Sixth Edition Hydrographic Data Book contains hydraulic tables, conversion tables, information on using water level recorders and a treatise on the sources of errors in float operated devices. The price is $1.00.

N.B. There is a charge for this book. Make checks payable to Leupold & Stevens Instruments, Inc.

### 113 IMPROVED AIRPORT RUNWAYS

**The Master Builders Co.**—How new concrete paving techniques have kept pace with the increased demands of jet-age aviation is graphically explained in this 20-page publication, which reports on nine important airport projects in the U. S., Canada, and the Dominican Republic. Cited are the roles played by Pozzolith in obtaining the high quality concrete required for this type of work; and Masterplate in providing wear-resistant, non-dusting concrete floors for hangars, cargo and other service buildings.


WHERE THERE'S A
BIG JOB
THERE IS A
KERN
INSTRUMENT

WORLD FAMOUS
precision surveying instruments... compact, rugged construction... fast, effortless operation. More reliable results in less time.

KERN'S NK3
precise level

Was used at Gloucester Anchorage of new Walt Whitman Bridge then under construction over Delaware River (Modjeski & Masters, Ammann & Whitney, Consultants to the Delaware Bridge Authority of Pa. and N. J.)

DESIGNED FOR HIGHEST PRECISION LEVELING

- Functional, down-to-fundamentals design—only 4½ lbs. (8 lbs. with carrying case).
- Coincidence level and fine tilt screw.
- Readings at a glance—level and rod may be read simultaneously through 30x Telescope.
- Mean leveling accuracy under normal conditions ± .008 ft. per mile.
- Kern AR coated optics produce substantial increase in brilliance and contrast of image.

*Write for Brochure NK 527 -2*

PROMPT, RELIABLE SERVICE
FACTORY TRAINED PERSONNEL

*Kern and Only Kern Offers You the Latest Designs of Dr. Henry Wild*

Kern SWISS
*The FINEST in SURVEYING EQUIPMENT*

KERN INSTRUMENTS INC.
120 Grand St., White Plains, N.Y.

## CATALOG DIGESTS

### 114 INCINERATOR STOKERS

**Flynn & Emrich Co.**—"F & E" Incinerator Stokers are described in separate brochures, one for stokers of the multi-cell batch charge type of plant and one for "Constant-Flo" type of operation. Full descriptions of both types of incinerator stokers are available in bulletins No. 1702 and 1703.

### 115 INDUSTRIAL PUMPS

**Johnston Pump Co.**—A series of bulletins on industrial applications of vertical pumps has been made available. It contains information on principal uses, head, capacity and temperature ranges, mechanical and hydraulic features, plus call-out drawings of various pump types.

### 116 INTERCOM 1000

**Bendix Aviation Corp., Bendix Computer Div.**—A four-page bulletin describing the unusual features of a programming method has been published. Known as Intercom 1000, this system has been designed for use with the G-15 general purpose digital computer and is a major simplification in the process of writing instructions to a computer. The system can be learned in four hours or less, with no previous computer experience.

### 117 JAW CRUSHER

**Straub Mfg. Co.**—Discussed in this 12-page booklet is the Kue-Ken jaw crusher, which crushes by pressure only, with no rubbing and minimum abrasion. The motion or path of travel of the plates is squarely against the rock, instantly gripping and crushing without rubbing. Photographs and specifications are included in Bulletin 608.

### 118 JETTING PUMPS

**Griffin Wellpoint Corporation**—A booklet illustrates jetting pumps for pile and caisson jetting, oil pipe line testing, water supply and fire protection. The illustrations show unusual set-ups for high-pressure jetting, including parallel and series pumping arrangements.

### 119 JOINTED VITRIFIED CLAY PIPE

**American Vitrified Products Co.**—This booklet discusses the jointed vitrified clay pipe, which is manufactured from plasticized resins of polyvinyl chloride. The design of the joint is based on the ball and socket principle. The material on the spigot end is a convex shape, with the bell end in a concave shape, permitting easy and rapid installation. When the joint is made, it reaches maximum compression which results in a really tight line, thus preventing infiltration, exfiltration and root penetration.

### 120 LIGHTING STANDARDS

**Kerrigan Iron Works, Inc.**—A multi-page loose-leaf catalog containing engineering data on steel and aluminum street lighting standards, mast arms and brackets is available. They are continuous tapered and octagon shaped for greater strength. The brochure contains comparison tables on strength of octagon shape over round and fluted shapes.

### 121 LIGHTWEIGHT PIPE & FITTINGS

**Naylor Pipe Co.**—New Bulletin No. 59 illustrates and describes spiralweld pipe for construction uses. Push-pull ventilation, high and low pressure air and water lines, dredging pipe, etc. in diameters from 4 to 30 in. It includes standard fittings, welded flanges, one-piece Wedgelock couplings, and connections for all pipe line requirements.

PLEASE BE PATIENT
YOUR REQUESTS TAKE TIME


SERVICISED
ZERO-LASTIC® JF
JOINT SEALER for the JET AGE

Impervious
to Jet Fuels...
keeps Joints Sealed
UNDER ALL CONDITIONS

Servicised Zero-Lastic JF Sealing Compound is a cold-applied, jet fuel resistant, rubberized tar compound specifically designed for sealing expansion, contraction, or dummy joints in concrete paving of airfields and airports. Zero-Lastic JF is easily applied to joints from ¼" up to 1" or more wide by any of several types of mixer-extruder units. Once installed, it cures internally into a resilient, rubber-like seal which has excellent bond with both sides of the joint. Since Zero-Lastic JF contains no thinner, there is no shrinkage after placing in the joint.

Because Zero-Lastic JF is unaffected by jet fuel or other petroleum solvents used by aircraft, joints sealed with the material stay sealed under the most adverse aircraft re-fueling and maintenance conditions. Zero-Lastic JF can be used with equal efficiency on new or old pavement joints.

*Write for complete details on Zero-Lastic JF and other Servicised Joint Sealing Compounds.*

SERVICISED PRODUCTS
CORPORATION
6051 WEST 65th STREET • CHICAGO 38, ILLINOIS

# VOSS
## BEARING PADS

*MEET EVERY REQUIREMENT*
*for*
***HIGHWAY BRIDGES-STRUCTURES***

**NEOSORB**
NEOPRENE AND
**SORBTEX**
PREFORMED FABRIC

We have checked every state, wherever bridge pads are specified. VOSS NEOSORB Neoprene or SORBTEX performed fabric pads meet or exceed state or federal specifications.

Leading contractors, steel fabricators and pre-stressed beam manufacturers from coast-to-coast rely on VOSS quality and low initial cost for their construction jobs.

VOSS Bearing Pads are specified for pre-cast, cast-in-place, pre-stressed and steel construction . . . for expansion joints, lighting standards and hand rail pads.

VOSS Bearing Pads are made to meet your shape, grade and skew condition. Send your job specifications to VOSS for prompt quotation.

**Preformed Pad Division**
**VOSS BELTING & SPECIALTY CO.**
**5645 North Ravenswood Avenue**
**Chicago 26, Illinois**

☐ *Send NEOSORB and SORBTEX data*

☐ *Have Sales Engineer Call*

**Name**_____

**Company**_____

**Street**_____

**City**_____ **State**_____


# CATALOG DIGESTS

### 122 LIGHTWEIGHT SHEET PILING

**L. B. Foster Co.**—This brochure lists specifications and uses of lightweight steel sheet pilings for protecting light-load excavations. Because of its box-type corrugated design, the interlock of lightweight sheeting cannot jam. It locks rigidly when installed, but comes apart easily. The literature shows how the piling, which can be rented or bought, can be reused repeatedly. Typical applications are shore protection, sump pits, sewer trenches, bulkheads, cofferdams, and building excavations.

### 123 LIMI-TORQUE CONTROL

**Philadelphia Gear Corp.**—28-page catalog L-550, gives background information on this automatic, power activated device for controlling all types of valves and sluice gates. It describes the available types and lists specific applications. Installations are shown in water and sewage plant, power plants, refineries, and in various industries.

### 124 LIQUI-SEAL UNIT LINE PUMPS

**Johnston Pump Co.**—A newly published bulletin on the company's "no-leak" line of vertical pumps designed particularly for the handling of volatile fluids, is offered. It covers the principal types of applications, plus a detailed description of the exclusive no-leak fluid bypass.

### 125 LONGSPAN JOISTS

**Haven-Busch Co.**—A 32-page catalog describing the longspan series joists SJI-AISC and includes Top Chord Extension graphs, maximum moment table, load-carrying tables, panel dimensions, and other pertinent design data.

### 126 LOUVERS, SOLAR CANOPIES, VENT HOUSINGS

**Brisk Waterproofing Co., Inc.**—An 8-page bulletin is available which discusses louvers, solar canopies, and vent housings. Some of the features of extruded aluminum louvers include reinforcing ribs and connections, positive drainage and weatherstripping. Diagrams and specifications are included in this brochure.

### 127 MAGNETIC FLOWMETER

**Fischer & Porter Co.**—New 6-page Catalog 10D1416 gives complete information on obstructionless Magnetic Flowmeter for metering difficult liquids such as concentrated acids and alkalis, slurries, paper pulp, waste sludges, sewage, pigment dyes, starch solutions, food products, black liquor, and similar corrosive, abrasive liquids. Principles of operation and advantages of the new meter, which will handle flows from a fraction of a gallon per minute to many millions of gallons per day, are discussed.

### 128 MASONRY CEMENT

**Lone Star Cement Corporation**—A 16-page, illustrated booklet outlines the advantages of Lone Star masonry cement in simplifying the problem of obtaining uniformly high-quality mortar, as well as the economy of one rigidly standardized, ready-to-use cementing material instead of two with no lime or Portland cement to add, and no soaking or sinking. It provides timely information on soundness, low absorption, high water repellency and other factors contributing to durable, weather-resistant performance. It contains easily-read graphs showing effect of mix proportions on water retention, strength and absorption, effect of mixing time on water retention, along with convenient reference tables for estimating quantities.

### 129 MASONRY DRILLING EQUIPMENT

**Sprague & Henwood, Inc.**—Information is available on "Oriented" diamond bits, waterswivels, adapters, and other equipment suited for Masonry Drilling. These masonry bits are available in several types and in sizes ranging from ⅜ in. O.D. to 14 in. O.D. Masonry diamond bits insure rapid, low-cost drilling through stone, reinforced concrete, asphalt, ceramics, and glasses.

### 130 MATERIALS HANDLING HANDBOOK

**The Ronald Press Co.**—A brochure and descriptive material on up-to-date, authoritative books of prime interest for today's civil engineers are available. Included is the unique Materials Handling Handbook, which covers such subjects as substructure and structural analysis and design, plasticity, soils engineering, strength of materials, air conditioning, etc.

### 131 MATERIALS HEATER

**Industrial Boiler Co., Inc.**—A booklet has been published which discusses the Materials Heater, a self-contained heating unit mounted on wheels. It eliminates boiler or oil heater, material tanks, oil tanks, water tanks, and piping and pumps. General specifications for the Model 106-O and Model 106-S and clear photographs are included.

### 132 MEASURING FLUMES

**Thompson Pipe & Steel Co.**—Four pages of tables on Free-Flow discharge for Parshall Measuring Flumes up to 20-ft throat width are included in the catalog describing this all-steel product which provides accurate measurement of water and fluids in open channels and ditches for irrigation systems, water works, sewage and industrial plants. They are also made of stainless steel and aluminum.

### 133 MECHANICAL DRAWING EQUIPMENT

**Eberhard Faber Pencil Co.**—A full color descriptive circular illustrating Microtomic Mechanical drawing pencils, woodcased drawing pencils and engineering erasers is available. Pencil numbers and trade names are Microtomic 607 lead holder and Microtomic 600 woodcased. Eraser numbers and names are 521 Race Kleen plastic eraser; 101 Pink Pearl; and 6002 Rubkleen.

### 134 MECHANICAL LOADING FROM DRAWPOINTS

**The Eimco Corp.**—Many mining methods are adaptable to loading with mechanical loaders at a distinct saving in cost and time. Open stopes of the flat vein type offer excellent opportunities, and shrinkage stopes in blocky ground are also efficiently handled with Rocker shovels. This 12-page bulletin has been produced to show through photographs and diagrams as many methods of loading as possible in the different mining systems where shrinkage or block carving can be employed. Also available is Bulletin L1058 which discusses the 40H and 40W Rockershovel. It is fully illustrated and contains a list of features and specifications.

### 135 METERS, FEEDERS AND CONTROLS

**B-I-F Industries, Inc.**—This catalog includes a series of illustrated thumb-nail descriptions of applications and equipment for water, sewage and waste treatment plants. The products include instruments for metering and controlling flow, liquid level, pressure and weight—chlorine gas feeders and butterfly valves; Proportioneers feeding and proportioning equipment for all chemical solutions, liquid blenders; Omega volumetric and gravimetric feeders for feeding and weighing dry materials and gravity feeders for liquids and slurries.

### 136 MIXED FLOW VOLUTE PUMPS

**C. H. Wheeler Mfg. Co., Economy Pump Div.**—A new 6-page catalog describes low and high-head mixed flow volute pumps for sewage disposal, drainage, flood control, irrigation, raw water pumping, or for any relatively clear liquids. Design and construction details for both horizontal and vertical mixed flow volute pumps are included. Units are built in 12-in. through 72-in. sizes, and in 3000 to 150,000 gpm capacities.

### 137 MODULAR SCHOOL DESIGN

**Macomber Inc.**—Available is an analysis of school design by Ronald S. Senseman, A.I.A., utilizing a four-ft cube module to standardize structural framing members in cost and fabricating time for schools expandable for all future growth from several basic plans, drawn to scale and providing a complete working analysis for integrated area arrangements.

### 138 MOTOR GRADER

**Allis-Chalmers Mfg. Co.**—Operating features of the Model D Motor Grader are outlined in a 16-page, 2-color catalog (MS-1319). It gives specifications on the grader's diesel and new gasoline engine. Information is also included on attachments, such as the scarifier, ¾ cu yd rear-mounted loader, shoulder maintainer and snow plow.

### 139 MOTOR GRADER

**Galion Iron Works & Mfg. Co.**—An informative 4-page bulletin on the Model 160 Motor Grader has been issued. The heavy-duty, constant-mesh, six-speed transmission of this big 160-hp grader, as well as other operating and construction features, are fully described and illustrated. Complete specifications are included.

### 140 OILLESS SELF-LUBRICATING BEARINGS

**Spadone-Alfa Corp.**—This literature describes Metaline Oilless Self Lubricating Bronze Bushings and Wear Plates for Industrial and Mechanical applications. Exclusive pre-molded lubricant assures dependable service under heavy load, high temperature, submerged and corrosive conditions. They are custom made in a wide variety of bronze alloys to meet the specific duty and application.

### 141 OPEN STEEL BRIDGE FLOORING

**Kerrigan Iron Works, Inc.**—A catalog on Greulich 4-way Grid, 5-in. depth. It contains illustrations, full engineering data including properties and load tables. The pamphlet explains the ease of filling half depth with concrete where needed, economical, speedy field erection, and why 20% fewer field welds are needed. Grid fabricated in panels 7-ft 3-in. wide with lengths up to 42-ft.

### 142 "OVERDRAIN" CLASSIFIER

**Hardinge Co., Inc.**—Some of the advantages of the "Overdrain" Classifier listed in this pamphlet are: very low maintenance and less than half the power of other standard screw or rake type classifiers; the teeter column at the overflow end insures efficient separation; fines and slimes once liberated from the sands are prevented from re-mixing with the sands; and very efficient in the field of washing and minimizes the amount of replacement liquid required to do a thorough job of cleaning.

### 143 PAVING HANDBOOK

**American Bitumuls & Asphalt Co.**—The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials. These include road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, with condensed Asphalt Institute specifications. Also, there is data on Laykold compounded asphalts for flooring, tennis courts, and protective coatings.

### 144 PAVING VIBRATORS

**Gar-Bro Manufacturing Co.**—Bulletin 106 gives information about the full depth Paving Vibrators, which are adjustable for depth and spacing, providing thorough vibration. The vibrators are mounted on a tubular frame and controlled by hydraulic cylinders which rotate the toolbar to set the angle of the vibrator units. The equipment can be attached to a concrete spreader and can be mounted on a special trailer.

### 145 PIER REPAIR

**Masonry Resurfacing & Construction Co., Inc.**—"Iron Girdle Holds Concrete for Bridge Pier Repair" is a reprint illustrating the methods and technique of "in the dry" repair of a 24-ft dia pier near Baltimore, Md. These procedures which revitalize deteriorated structures and add many years of useful life to an old structure are similar to those utilized in the "Dri-Por" system of pile repair. Many illustrations clearly show the work in various stages of repair.

### 146 PILE REPAIR

**Masonry Resurfacing & Construction Co., Inc.**—A new 8-page illustrated booklet is offered describing the "Dri-Por" system of pile repair and encasement applied to bridges and piers. The booklet describes several interesting applications of the "Dri-Por" system and relative costs. Also included is a description of the "Dri-Por" K-Box which allows repair of concrete piling "in the dry."

DID YOU MAKE YOUR CHECKS PAYABLE TO THE PROPER COMPANIES? ARE THE AMOUNTS CORRECT?


THE TREND
IN DRAFTING ROOMS
THROUGHOUT
THE WORLD IS
TOWARD IMPERIAL,
THE WORLD'S FINEST
TRACING CLOTH

*No other filtering medium compares with*

**ANTHRAFILT**
Trade Mark Reg. U. S. Pat. Off.

**Anthrafilt stands alone as the one filtering medium that is best for all types of filters.**

Years of efficient and economical use in every type of filter plant has made ANTHRAFILT the standard of excellence in the filtering medium field.

**ANTHRAFILT**
*offers important advantages over sand and quartz*

DOUBLES length of filter runs. ● REQUIRES only half as much wash water. ● KEEPS filters in service over longer periods. ● INCREASES filter output with better quality effluent. ● GIVES better support to synthetic resins. ● PROVIDES better removal of fibrous materials, bacteria, micro-organic matter, taste, odor, etc. ● IDEAL for industrial acid and alkaline solutions. ● EFFECTIVE filtration from entire bed. ● LESS coating, caking or balling with mud, lime, iron, or manganese.

IDEAL FOR USE IN EVERY TYPE OF FILTER

*Write for further information, test samples and quotations to:*

**PALMER FILTER EQUIPMENT CO.**
P.O. Box 1696—822 E. 8th St., Erie, Pa.
*Representing:*
**ANTHRACITE EQUIPMENT CORP.**
Anthracite Institute Building, Wilkes-Barre, Pennsylvania

# CATALOG DIGESTS

### 147 POINT TO POINT TELECOMMUNICATIONS

**Marconi's Wireless Telegraph Co. Ltd.**—Published three times yearly, "Point to Point Telecommunications" is designed to interpret trends and techniques in telecommunications for the benefit of the user and for the practical systems planning engineer. It deals with the more practical aspects of communications and in particular point-to-point fixed services.

### 148 POLYVINYL PLASTIC WATERSTOPS

**Servicised Products Corp.**—Polyvinyl Plastic Waterstops with the unique "dumbbell design" are described and illustrated in detail in a new catalog recently released to the field. This design, available either in a flat or centerbulb type, provides maximum protection against water for construction joints, expansion joints, in canal linings, outlet works, spillways, dams, sewage treatment plants, retaining walls and abutments. Its design is such that it provides a self-sealing action that, as the concrete contracts and the joint opens up, it becomes more tightly engaged with the concrete, thus assuring a tighter seal as the tension increases either from joint movement or increased water pressure.

### 149 PORTABLE GASOLINE RAMMER

**Barco Manufacturing Company**—Offers an eight-page catalog describing the Barco portable gasoline rammer for soil compaction. This tool is the only successful mechanical means of obtaining specified soil compaction in restricted areas such as in trenches and near walls and bridge abutments. It is easy to operate, safe, and will compact 20 to 30 cubic yards of fill per hour where high degree compaction is specified. Barco also offers a bulletin "Cost Data for Soil Compaction in Restricted Areas with the Barco Rammer" of interest to all earthmoving contractors.

### 150 PORTABLE PILE HAMMER

**Vulcan Iron Works, Inc.**—Some of the features of the pile hammer discussed in this pamphlet are: differential-acting; modern clean design; easiness of lubrication; economically priced; and compact for close quarters and ease of handling.

### 151 POSITIONS AND PERSONNEL AVAILABLE

**Cadillac Associates, Inc.**—Two monthly publications are offered without charge: The Career Builder, containing complete descriptions of the best available positions in the construction industry; and The Construction Engineer Finder, for firms who are seeking executives and engineers. Typical of the executive requirements listed in the current issue of The Career Builder are verified openings for president, general manager, chief engineer, and project engineer.

### 152 PRECAST CONCRETE BRIDGE MEMBERS—AMDEK

**American-Marietta Co.**—An 8-page folder shows how Amdek prestressed, pretensioned concrete spans revolutionize bridge construction methods. It also illustrates skew beam tests, load distribution tests and tests to destruction being conducted in independent laboratories.

### 153 PRECAST STRUCTURAL CONCRETE

**Freyssinet Co., Inc.**—Prestressed Concrete News, Vol. 1, 1959, discusses the erection of a precast, prestressed railroad bridge in Allouez, Wis. Photographs and specifications are included. Pictures of railroad bridges built in Japan and India are also shown.

### 154 PRESTRESSED CONCRETE TANKS

**The Preload Co., Inc.**—"The Design of Preload Tanks", Bulletin T-19 is a completely illustrated 8-page booklet describing the design calculations for a prestressed concrete tank. Complete formulas are given for floor, wall, dome and dome ring design.

### 155 PRESTRESSED CONCRETE TENSIONING MATERIALS

**John A. Roebling's Sons Corp.**—This brochure is a comprehensive introduction to the country's most rapidly-growing construction method. It contains 13 pages of text, photographs and drawings of various structures and pretensioned bonded prestressed concrete members and their applications. There is a full description of a prestressed casting bed and how it works and graph and technical data on tensioning strands.

### 156 PRICE LIST

**Clipper Manufacturing Co.**—The current price list includes specifications of the 2-hp Supermatic Masonry Saw and 1½-hp Select-A-Notch Masonry Saw, accessories, concrete saws, diamond, break-resistant abrasive and wet or dry abrasive blades for masonry and concrete sawing. Colorful brochures are available illustrating and outlining specifications on all masonry saws and the entire line of concrete saws with 36, 30, 18 and 9-hp gasoline engines, and 5-hp electric motors. Of special interest to municipalities and industrial plants planning expansion or renovating projects, is a new 4-page brochure on Sawed Excavations.

### 157 PROPELLER PUMPS

**Johnston Pump Co.**—A new 6-page bulletin describing the characteristics, applications and recent improvements made in its complete line of large volume propeller pumps has been made available by the company.

### 158 PROTECTIVE COATINGS AND LININGS

**Lithcote Corp.**—Some of the protective coatings and linings discussed in this 8-page, illustrated booklet are: LC-19, non-toxic, odorless, impervious lining developed to withstand rapid thermal change as well as sustained immersion at elevated temperatures; LC-24, a straight, baked phenolic which has excellent resistance to mechanical abrasion and good resistance to bending and thermal shock; and LC-610, a modified epoxy type coating which is unaffected by heat up to 200 deg F and has excellent weathering properties.

### 159 PUMPING STATIONS

**Zimmer & Francescon**—Completely prefabricated Underground Pumping Stations, in a range of sizes to suit all applications where extensions to sewer systems require that the flow be raised to the level of existing mains, are described in this 8-page bulletin. Engineers and Contractors for sub-divisions, shopping plazas, industrial sites and similar projects will be interested in the automatic operating features and simple installation requirements of these stations.


**NOW NEW**

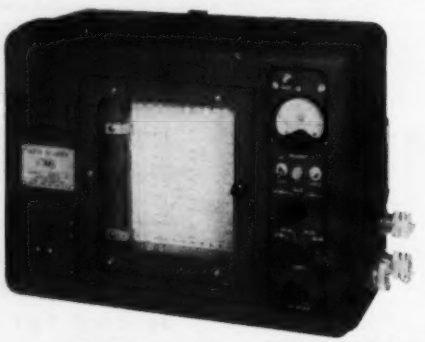
Edo

**MODEL 255C**

**SURVEY DEPTH RECORDER**

**more accurate,**

**more versatile than ever**



*Hinged viewing window and housing which drops down to allow access to interior contribute to ease of operation and maintenance of Edo Model 255C Survey Depth Recorder.*

EDO, acknowledged leader in the design and manufacture of echo-sounding devices, now offers a vastly improved Precision Survey Depth Recorder—Model 255C—for permanent or temporary installation aboard vessels of every size.

Extremely accurate, light in weight (only 55 lbs.) and easy to operate, Model 255C is the ideal recorder for deep depth, penetration and general underwater survey. Accuracy is within ½ of 1 per cent, in water depths from 1-½ feet to 230 fathoms. Bottom readings are recorded permanently and with knife-sharp definition on overlapping range scales, in feet or fathoms. Wide transducer beamwidth —20 degrees at minus 10 db points—assures excellent penetration and broad recorder coverage.

FOR CERTAIN SPECIFIC APPLICATIONS—such as underwater dredging and cable laying where detailed bottom contour information over a relatively small area is required—Edo also offers its new *Model 255D*. Conversion to the narrow beamwidth configuration (6 degrees at minus 10 db points) is achieved simply by the exchange of certain components of the 255C and substitution of a specially built transducer.

*Send for new illustrated brochure, Dept. 2-V.*

Edo **CORPORATION, College Point, L. I., N. Y.**


PLEASE PRINT
NAME CLEARLY

### 160 Q—AIR FLOOR SYSTEM

**H. H. Robertson Co.**—This 28-page catalog contains information concerning the modern structural, electrical, air conditioning, subfloor construction. It describes in detail the design features built into this new approach to air distribution systems. Technical drawings, diagrams, cutaways and installation photographs show how ceiling-to-floor-above compaction can save one story in twenty—how the patented Robertson seasonal changeover feature can cut power consumption for heating and air conditioning of industrial and commercial buildings.

### 161 R/C DUCT FLOORS

**Concrete Reinforcing Steel Institute**—A 16-page booklet entitled "Electrical Outlets Wherever You Need Them," has been published which gives complete details on R/C Duct Floors, a development which provides 100% electrical flexibility for buildings at a new low cost. They consist of standard reinforced concrete joist floors with a network of electrical distribution ducts buried in the structural slab. With this type of construction, no special concrete "fill" is needed.

### 162 RECOMMENDED WEAR LIMITS

**Caterpillar Tractor Co.**—A list of recommended wear limits to Caterpillar crawler tractor track rollers is a feature of a new booklet. These wear limits are established as a basis for determining the most practical and economical time for having track rollers built up. Entitled "Don't Buy in the Dark," the brochure illustrates why it is important to use genuine Caterpillar replacement parts in the track components of Caterpillar-built crawler tractors.

### 163 RECTANGULAR RIVETED ALUMINUM GRATING

**Kiemp Metal Grating Corp.**—This 4-page brochure contains specifications and safe load tables for Rectangular Riveted Aluminum Grating. This grating is light, strong, clean, rigid, and corrosion-resistant. Also available is a catalog on Grating and Stair Treads which contains information on welded grating, riveted grating, and Riv-Dexteel Bridge Decking and safety stair treads. Actual installation photographs are included.

### 164 REINFORCED CONCRETE PIPE—HI-HED

**American-Marietta Company**—A pamphlet containing many photos showing how elliptical Hi-Hed Reinforced Concrete Pipe saves trench width in congested areas and has up to 50% greater strength than its round pipe equivalent. Includes charts on headwall details, physical characteristics and hydraulic properties and discharge graphs. Also folder on elliptical Inner Circles Pipe illustrating quick passage of pipe through pipe underground without disruption of surface traffic.

### 165 REPRODUCTION FILMS

**E. I. Du Pont de Nemours & Co.**—A colorful, descriptive 6-page folder on Cronaflex engineering reproduction film is available. This folder clearly and concisely describes the properties and uses of the three Cronaflex films: direct positive; contact; and projection. Cronaflex is a line of engineering reproduction of drawings, plans and maps. All Cronaflex films are on Du Pont Cronar® polyester photographic film base.

### 166 REXON VIBRATION MOUNTS

**Hamilton Kent Mfg. Co.**—This 8-page, illustrated brochure contains information on Rexon Vibration Mounts, which bring to the science of vibration insulation a radically new principle in mount design: a design that combines the high vibration dampening properties of rubber loaded in shear with the safety, durability and ease of installation of a simple compression mount. Virtually indestructible, they cannot be damaged by either temporary or permanent overloading. There are no rubber-to-metal bonds, either chemical or mechanical to separate in use.

### 167 RUBBER WATER STOPS

**The Gates Rubber Co.**—Revised bulletins on rubber water stops are being offered. One of the improvements introduced in the new literature is a high strength "chemical bond" for fast efficient splicing of waterstops. Called "Kwik-Seal", this waterstop splice is accomplished in the field in 1 to 3 min, up to 10 times faster than was formerly possible.

### 168 SAND HOG EQUIPMENT

**Mayo Tunnel and Mine Equipment**—Colorful, new Bulletin No. 23 illustrates Tunnel Shields, Air Locks, Lock Doors and other Sand Hog Equipment employed in many parts of the world.

### 169 SANITARY ALUMINUM GRATING

**Washington Aluminum Co.**—This brochure shows how aluminum flooring, platforms, ladders and shelving are being utilized wherever safe and sanitary conditions are necessary—food and meat packing plants, bottling works, poultry and dairy plants. Aluminum offers many advantages over wood and steel as it won't corrode; does not absorb odors of meat, fish, poultry, sea food, etc.; washes completely clean with only a quick hosing; won't splinter, crack or peel; and is lightweight.

### 170 SAWING MACHINE

**Concut Sales, Inc.**—A bulletin describes the improved Jointmaster Sawing Machine which is recognized as the most practical and efficient machine for large air base and highway sawing jobs. The machine is equipped with hydraulic drive for easy handling. The saw carriage is raised and lowered hydraulically and it has hydraulic torque converter cross feed. Up-cut action increases blade life. The Jointmaster is available in 12-ft and 24-ft models.

### 171 SCOPE IN METAL CONSTRUCTION

**Pittsburgh-Des Moines Steel Co.**—A 36-page General Brochure describes the capabilities and diversities of PDM Metal Construction. The facts presented serve as a useful measure of the highly developed knowledge and craftsmanship of the company in engineering, research, fabrication and construction of steel, stainless steel, stainless clad steel, alloy and aluminum.

### 172 SCRAPER BLADE BOOKLET

**International Harvester Co.**—"Here's the Inside Story on Cutting Edges" is the title of an 8-page, two-color booklet, which describes how operators can get considerably longer life from cutting edges on their dozers and scrapers with exclusive IH Durablades. These blades, produced by a special heat-treating process, have a surface hardness giving two to four times longer life than untreated blades. A controlled tempering process produces a tough, shock-resisting core enclosed within a deep-hardened wearing surface. As a result, the surface is almost file-hard, while the core remains tough and ductile to swallow impact without breaking.

### 173 SEEPAGE AND POLLUTION CONTROL

**Gulf-Seal Corp.**—Presents dependable Prefabricated Asphalt Lining in its Engineering Brochure (Fourth Edition). Included are installation details, specifications, and photographs of numerous installations. The tough, flexible lining is designed to solve many problems involved with the storage of industrial salt water and waste chemicals, municipal treated and untreated water, and relining steel and concrete reservoir surfaces.

*Please give your complete address.*

NO-LEAK PUMP FOR VOLATILE FLUIDS

JOHNSTON VERTICAL UNIT-LINE

- No mechanical seal to abrade or corrode.
- *Positively will not leak fluid or vent vapor to atmosphere.*
- Applications wherever safety and maintenance are factors. Takes small surface space.
- For installations where pump's supply is vented to atmosphere.
- Developed for Atomic Energy Commission for handling radioactive wastes.

Dealers in all principal cities.

Clip coupon for specifications and colorful bulletin.

JOHNSTON PUMP COMPANY

A Division of
The Youngstown Sheet and Tube Company
Pasadena, Calif.

JOHNSTON PUMP CO.
Bin K
Pasadena, California

*Send me Unit-Line Pump Bulletin*

NAME

ADDRESS

FIRM

### 174 SELF-LUBRICATING BEARINGS

**Lubrite Div., Merriman Bros., Inc.**—Manual No. 56 is a 20-page book filled with complete information, technical data, and specifications about self-lubricating bushings, bearings, and washers for industrial equipment, machinery, Hydro-electric, high temperature, missile and atomic applications.

### 175 SELF-LUBRICATING EXPANSION PLATES

**Spadone-Alfa Corp.**—Literature providing complete information covering Metaline oilless self-lubricating expansion plates and bridge bushings; also, Metaline bearings for underwater installations as found in dam and hydro-electric projects. Metaline products fully meet all federal and state requirements covering this type of material. This exclusive lubricant assures long, dependable service in heavy load, high temperature, submerged and corrosive applications.

### 176 SELF-LUBRICATING EXPANSION PLATES & BUSHINGS

**Lubrite Div., Merriman Bros., Inc.**—Manual No. 55 contains complete information, technical data, and specifications about self-lubricating expansion plates and bushings for bridges, buildings, refinery equipment, chemical processing equipment, high temperature, missile and atomic applications.

### 177 SEWAGE LIFT STATIONS

**Smith & Loveless, Inc.**—This 100-page Engineering Data Manual on factory-built sewage lift stations—pneumatic ejector and pump—contains design notes, selection charts, dimension drawings, suggested specifications, a list of installations, and installation and operating instructions. Standard lift stations range in capacity from 20 gpm to 4000 gpm.

### 178 SEWAGE REGULATORS

**Brown & Brown, Inc.**—manufacture a line of float controlled quadrant gates, in 37 sizes, to automatically control the diversion of sanitary flows from combined sewers to interceptors. Such automatic gates may be actuated either from head or tailwaters or dually from two sources. Bulletin 81A contains capacity and dimension charts.

### 179 SEWAGE TREATMENT EQUIPMENT

**The Eimco Corp., Process Engineers, Inc. Div.**—Included in this illustrated brochure on new equipment which will facilitate treatment of sewage wastes are: grit separators, clarifiers, flotator-thickeners, non-clog diffusers, digester mixers, rotary distributors, oxidators, cleanable sight glasses, and flotator-clarifiers. Also available are Bulletins SM-1003 and SM-1008 on Eimco-Process Flotators and Flotator-Clarifier.

### 180 SEWAGE TREATMENT PLANTS

**Smith & Loveless, Inc.**—A 20-page Data Manual on "Oxigest" Factory-built Sewage Treatment Plants for housing developments, schools, motels, and factories, contains design notes, selection charts, engineering drawings and suggested specifications.

### 181 SHEETING HAMMER

**Vulcan Iron Works Inc.**—Sheet Bulletin 35 describes the all new Model DGH-900 Sheeting Hammer, which has a 900 lb weight of striking parts, a rated striking energy of 4000 ft lb, and will deliver 236 blows per minute. The hammer will also drive steel bearing piles, concrete bearing piles and wooden piles.

### 182 SINGLE ACTING PILE HAMMER

**Vulcan Iron Works, Inc.**—Just issued is a 20-page engineering bulletin, No. 68-F, on the selection and application of single-acting pile hammers with rated striking energy from 7260 to 30,225 ft lb. The brochure is very comprehensive and deals with many subjects such as rating of hammers, selecting size required, safe bearing load for piles, adaptability for driving, bases, plates, driving heads, helmets, and head blocks.

### 183 SINGLE PASS SOIL STABILIZER

**Harnischfeger Corp.**—Contained in this illustrated brochure is a description of the five operations performed by the single pass soil stabilizer. It shaves and pulverizes the in-place materials, thoroughly blends all dry materials, applies all liquids uniformly, provides final mixing in twin pug mill, and spreads all processed materials evenly. Also available is a catalog devoted to the Model EA-58 single soil pass stabilizer. Both include specifications.

### 184 SLUICE GATES

**Rodney Hunt Machine Co.**—The first basic improvement in sluice gates in many years, the patented HY-Q flush bottom closure sluice gate, is described in Catalog 75. This booklet, with 12 pages of illustrations, clearly shows all details of construction, installation, and operation of the unique gate as used in water filtration plants, power plants, municipal and industrial plants, dry-docks, and flood control.

### 185 SLURRY SEAL

**American Bitumuls & Asphalt Co.**—"Bitumuls Slurry Seal" is an operation which consists of mixing the aggregates with Bitumuls and water to a slurry consistency in a transit mixer, and spreading over the pavement by a specially constructed squeegee type spreader-box. The action of the squeegee forces the slurry into the fine cracks of a weathered but still sound surface of an old asphalt pavement, thereby reducing expensive maintenance patch construction to a minimum.

### 186 SOIL COMPACTION

**Barco Mfg. Co.**—The Vibra-Tamp, a versatile tool for maximum compaction of granular base materials and bituminous surfacing, is the subject of a 4-page bulletin. Whereas the Rammer covers the cohesive type soils where impact compaction is necessary, the Vibra-Tamp covers the non-cohesive type soils where surface finish is desirable. Specifications and on-the-job photos are included in the brochure.

### 187 SOIL COMPACTION

**Vibroflotation Foundation Co.**—Available is a booklet entitled "Soil Compaction by Vibroflotation" which describes the soil consolidation and engineering services of the Vibroflotation Foundation Co. The booklet illustrates the compaction of 8 to 10-ft cylinders of sandy soil to provide a firm foundation of sand for any type of structure. To make sure of complete coverage in a given area, these cylinders are overlapped according to a predetermined pattern under individual loadings or under entire building areas.

### 188 SOIL SAMPLING

**Acker Drill Co., Inc.**—Called "Basic Procedures of Soil Sampling," this easy-to-follow guide for the builder, construction contractor, civil engineer or architect, contains information on the latest methods, procedures and tools used for soil sampling. The text is illustrated throughout with more than 100 drawings and actual field photos. The price is $1.00.

N.B. There is a charge for this book. Make checks payable to Acker Drill Co., Inc.

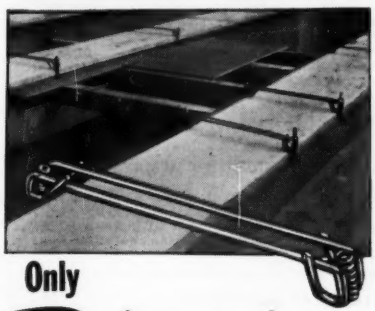
F/S OPTICAL THEODOLITE
Model 4149
with Self-Indexing Unit
A time saving automatic feature ensures sufficient verticality of the main axis and accurate indexing of the vertical circle by simply centering a bull's eye level.
• Both circles viewed simultaneously
• Horizontal scale with optical vernier to 30 seconds. Vertical scale to 1 minute
• 25X Telescope, erecting
• Built-in Telescope vial
• Single-lever repetition control
• Servicing by factory specialists
F/S offers a complete line of high quality engineering instruments. Ask your nearest dealer or write today for detailed literature.
FILOTECNICA SALMOIRAGHI, INC.
254 5th Ave. New York 1, N. Y.
DEALERS' INQUIRIES INVITED

*F/S DISTRIBUTORS: The A. Lietz Co., San Francisco and Los Angeles, Calif.—National Blue Print Co., Chicago, Ill.—Watts Instruments, Columbus, Ohio—Geo. F. Muth Co., Inc., Wash., D. C.—CANADA: Instruments 1951 Ltd., Ottawa, Toronto, Regina, Montreal.*

# SPEED SAFETY ECONOMY

## With Richmond Hanger Frame-Ty Systems for Slab Form Support

The effectiveness of slab form support is measured in three terms: speed, safety and economy. Richmond Hanger Frame-Tys are ideally suited for this type of construction. One popular unit is the "Free-Fit" type.



**Only Richmond Free-Fit Hanger Frame-Tys Give You—**

1. **Continuous heavier wire construction.**
2. **Nut tightening from top to eliminate need of scaffolding for under beam work.**
3. **Oversized coil to allow easier tightening of nut from above.**
4. **Improved design to give better bearing and greater rigidity.**
5. **Positive means of tightening against beams or girders to prevent leakage of concrete.**
6. ***Published* safe loads and ultimate strengths.**

The various types of Richmond Hanger Systems and their applications are detailed in the current Richmond Handbook. Send for your FREE copy—and, if you have specific concreting problems, let Richmond's Technical Department help you.

Write to:—

Richmond
SCREW ANCHOR CO., INC.
816-838 LIBERTY AVE., BROOKLYN 8, N.Y.
315 SOUTH FOURTH ST., ST. JOSEPH, MISSOURI
INSIST ON RICHMOND AND BE SURE IT'S RICHMOND


## CATALOG DIGESTS

### 189 SOILS, ASPHALT, CONCRETE TESTING APPARATUS

**Soiltest, Inc.**—The company offers a new 8-page New Products Bulletin illustrating and describing Beggs Deformeter Apparatus, heated laboratory mixers, concrete testers, pile loading ram, kneading compactor, sand equivalent test and liquid limit device.

### 190 SOILS, BITUMINOUS, CONCRETE TESTING EQUIPMENT

**TESTlab Corp.**—A 128-page General Catalogue of new equipment, apparatus, and supplies for the laboratory and field physical testing of soils, bituminous, concrete, and other engineering materials is available. Items are described, illustrated, and listed in an all new inventory system of numbers in logical order of use.

### 191 SOIL TESTING DEVICE

**Charles R. Watts Co.**—Full information is available on the Dens-O-Meter, which was developed after years of research by the Department of Highways, State of Washington. It is now in general use for making field density and moisture tests in wide range of soils, including fine, coarse granular base and gravel. It is accurate and fast in small or large holes up to 3 ft deep.

### 192 SPEED REDUCERS

**The Earle Gear and Machinery Company**—A sixteen-page illustrated catalog, describing speed reducers as applied to operating machinery, particularly bridge machinery, is available. Outlined are specifications service factors, horsepower ratings and dimensions of the particular units illustrated. Gasoline power units are also dealt with in a compact, easy-to-read form. Photographs are shown of actual installations with miniature blueprints included.

### 193 SPRAYED-ON FIRE PROTECTION

**Keasbey & Mattison Co.**—Folder SL-8 gives up-to-the-minute information and technical data on Sprayed "Limpet" Asbestos, including results of its most recent fire tests. Its application to metal beams and columns as well as to cellular steel floors is illustrated and fire ratings listed for each type of use. Sprayed "Limpet" Asbestos now offers protection from flames up to five hours depending upon the thickness of the blanket.

### 194 SR CLARIFIER

**Dorr-Oliver Inc.**—This 4-page, two-color bulletin entitled, "The Dorr SR Clarifier," describes the design features and advantages of the new final unit for continuous, rapid sludge removal. Bulletin No. 6193 also includes installation photographs and line drawings of the unit, and a chart of design data.

### 195 STEEL FLOOR ARMOR

**Klemp Metal Grating Corp.**—A Specification and Installation Manual on Hexteel and Floorsteel Steel Floor Armor is offered. Photographs are included. Also available is a 4-page brochure on Hexteel, containing uses, specifications, and photographs.

### 196 STEEL JOISTS

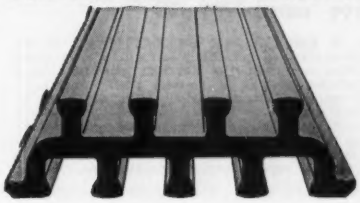
**American Bridge Division**—This 40-page steel joist catalog contains complete design information for spans up to 120-ft. Such subjects as design calculations, bridging, properties and dimensions, end details and accessories, load tables, marking systems for ordering, and specifications are clearly and completely covered in this catalog.

### 197 STEEL JOISTS

**Macomber Inc.**—This catalog discusses SJI approved joists with all structural applications and design details for masonry and steel, including dimensional and property tables and loadings.


# LABYRINTH WATERSTOPS

## A SOUND INVESTMENT FOR CONCRETE CONSTRUCTION!



LABYRINTH AVAILABLE IN 2, 3 or 4 rib.

## ON YOUR CONSTRUCTION:

**1.** Consider the investment in design, materials and labor (to mention a few).

**2.** Then consider how important safe, secure *watertight* concrete joints are.

**3.** Thorough watertightness *can* be secured by installing Labyrinth Waterstops—a dividend that makes the low initial cost of the product insignificant when compared to your total investment—and one that insures watertight concrete joints for years!

- Corrugated ribs grip concrete, insure an everlasting bond between joints.
- Finest polyvinyl plastic resists chemical action, aging, severe weather.
- Takes just seconds to nail to form . . . easy to cut and splice on location (prefabricated fittings available).
- There's a Water Seal product for every type of concrete work!

If your aim is to stop water seepage, *stop it effectively with Water Seals' Waterstops!*

**"See Us in SWEET'S"**

New Literature and Free Samples Sent on Request—Use Coupon Below

**WATER SEALS, *inc.***
**9 SOUTH CLINTON STREET, CHICAGO 6, ILL.**

Made in Canada for J. E. Goodman Sales, Ltd. Toronto, Ontario

WATER SEALS, INC. DEPT. 1
9 S. Clinton Street
Chicago 6, Illinois
***Please send free sample and descriptive literature.***

Name_____

Company_____

Address_____

City_____ Zone____ State_____

### 198 STEEL PLATES

**Bethlehem Steel Co., Inc.**—This 64-page catalog contains a complete description of plates, comprehensive design information, metallurgical data, and tables and diagrams for use by plate fabricators and engineers. It is thumb-indexed, and has full-page illustrations of outstanding plate applications.

### 199 STEEL SHEET PILING

**L. B. Foster Co.**—A 20-page catalog lists the advantages of renting interlocking steel sheet piling and contains specifications for piling sections, as well as corners and connections. Drawings illustrate various types of sheet piling, and data is provided on dimensions, weight, and section modulus. Diagrams showing construction of several types of cofferdams are also included. On-the-job photos illustrate several typical installations.

### 200 STRATAGRAPH

**Edo Corp.**—An illustrated brochure describes the Model 400 Stratagraph, strata penetrating sonar which records, with sharp definition and complete accuracy, formations underlying rivers, lakes and other relatively shallow bodies of water. Sediment, intermediate layers, bed rock and faults are readily distinguished and pictorially shown on permanent chart. The brochure illustrates equipment and typical recordings.

### 201 STRUCTURAL CONCRETE INSERTS

**Richmond Screw Anchor Co., Inc.**—A line of high-strength inserts suitable for curtain wall anchorage to structural concrete, and various applications to precast concrete work, is illustrated in this four page bulletin. Certified test report, working loads, ultimate strengths, sizes and specifications are given. Line drawings illustrate methods of application to concrete forms and some suggested use details.

### 202 SURFACE TREATMENTS

**American Bitumuls & Asphalt Co.**—"Bitumuls Surface Treatment Manual" is a new two-color, 64-page round-up of factual, practical information on all phases of this type of pavement maintenance. Of special note is the attention given to proper evaluation of pavement distress ahead of specifying type of treatment. The manual is heavy on the "how-to" aspects of treatments, from "Black Seal" through "Armorcoats." Other features include a "Glossary of Terms" and a section of useful tables.

### 203 SURVEY DEPTH RECORDER

**Edo Corp.**—Literature describes and illustrates new Models 255C and 255D Survey Depth Recorders, with sample recordings. Precision sonar equipment measures depth of water (0-230 fathoms) with great accuracy. Compact unit is readily installed on all types of survey vessels. Model 255D, with narrowed beamwidth, records with exceptional detail in relatively small areas.

### 204 SURVEY FOOT-ODOMETER

**Speedometer Electric Co.**—Information is available on the Survey Foot-Odometer, with which it is possible to measure distances in terms of feet with the quickest, safest, most convenient and economical means while driving a car and to easily get highly accurate results approaching steel-tape precision. This instrument is recommended for large scale highway planning surveys; taking required ground measurements to compute the scale of aerial photographs; and making preliminary surveys.

### 205 SURVEYING INSTRUMENTS

**Filotecnica Salmoiraghi, Inc.**—The company offers free of charge a new General Catalog and detailed manuals on the fine Levels (self-leveling and conventional), Optical Theodolites, Planimeters, etc. advertised in "Civil Engineering" and other professional magazines. The F/S instruments, made since 1865 in Milano, Italy, are distributed and serviced by the leading dealers throughout the United States.

### 206 SURVEYING INSTRUMENTS

**W. & L. E. Gurley**—The complete line of Gurley surveying and engineering instruments, including transits, levels, alidades, are described in the revised edition of Catalog 50. Transits described include the Hell Gate Precise Transit; Standard Precise Transit; Gurley Telescopic Solar Transit; Standard Precise Mining Transit; Optoplane Precise Transit for industrial use; Optical Plummet Transit. Included are cross-sectional drawings of many of the transits.

Return the coupon today!

### 207 SURVEYING INSTRUMENTS

**Kern Instruments, Inc.**—A 32-page brochure offers a brief description of the most important instruments manufactured by Kern & Co., Ltd., of Aarau, Switzerland. Fully illustrated, it acts as an index to the detailed literature available on each instrument. Included in the brochure are theodolites, levels, self-reducing tachometers, alidades, pentagonal prisms and many other instruments.

### 208 SURVEY MARKERS

**Copperweld Steel Co.**—This 4-page booklet, in color, lists specifications and describes both types of Copperweld Markers: the bronze head—to be driven flush into paved or even surfaces, and the tinned end—for quick visibility in uneven or heavily-foliaged areas. The pamphlet also includes an explanation of the Molten-Welding process by which the copper and steel in all Copperweld Products are inseparably united.

### 209 SUSPENSION BRIDGE TECHNICAL DATA

**John A. Roebling's Sons Corp.**—A 12-page booklet containing the necessary information to enable the designer, builder or user of a small suspension bridge to make up preliminary calculations is now available. Included are approximate lengths and cable tensions, catenary formulas, erection calculations, and notes on suspension bridge design.

### 210 SWIMMING POOL EQUIPMENT

**National Pool Equipment Co.**—Offered to Engineers is a descriptive residential and commercial catalog, as well as specific information and drawings for a complete line of swimming pool equipment, and its new contemporary and ultra-contemporary equipment.

### 211 SWIMMING POOLS

**Smith & Loveless, Inc.**—A new 25-page Data Manual on Swimming Pool Filtration Equipment for municipal and country club pools. Contains design notes, selection charts and suggested specifications.

### 212 SYNCHRONIZED JACKING SYSTEMS

**Elgood Equipment Corp.**—The manufacturer offers 14 single-page fact sheets concerning applications of jacking systems for bridges, pipe pushing, erection, hangars, and prestressing. Some of the systems applied include Four Point Synchronized Tensioning System, Two Point Tensioning System, and Single Strand Tensioning System.

### 213 SYNTHETIC FILTER MEDIA

**The Eimco Corp.**—Some of the synthetic fabrics available for filtration equipment which are described and illustrated in Bulletin P2037 are: nylon, orlon, polyethylene, saran, teflon, and dynel.

### 214 "T-1" ALLOY STEEL

**United States Steel Corp.**—The most comprehensive collection of facts and data about USS "T-1" constructional alloy steel. Complete data on available sizes, forms, conditions, fabrication, welding and application of this 3-times stronger than structural steel product. Complete properties and characteristics. 64 pages.

### 215 TDM TRAC-DRILL

**Joy Manufacturing Co.**—The TDM Trac-Drill is the automatic answer to low-cost, mass-production blasthole drilling, according to this 8-page catalog. Further, it states that this ruggedly built, self-propelled drill will cover the roughest terrain and spot and bottom holes up to 4 in. in dia and 40 ft deep, faster than any similar type drill. It will drill at practically any angle and thanks to its air-operated, piston-type hydraulic pump all movements are fast and sure. Also available is a brochure on the TDL Trac-Drill, the latest development in lightweight, self-propelled drill carriers.

### 216 TECHNICAL DATA CATALOG

**Lefax Publishers**—A newly revised catalog for 1959 of Lefax Pocket Size Technical Data Books has been announced. Selling at $1.25 each, these handy books cover every field of engineering and are of constant use to engineers, technical men, surveyors, shopmen, teachers and students. They contain about 140 loose leaf pages of concise, comprehensive, and authoritative material. A partial list includes highway engineering, surveying tables, surveying theory and practice and conversion tables. The catalog will be sent free of charge.

### 217 TELE-PLUMB

**Warren-Knight Co.**—In addition to a cutaway drawing of the Tele-Plumb, instructions on how to use the instrument, and prices, this pamphlet contains a list of special features such as: elimination of the Plumb Bob; nothing to attach or detach between set ups; and can be used on Transits or Transit-Levels. Also includes a description of the Piano-Shift Model 90-S.

DIG DRY

It's Faster and Cheaper
MORETRENCH WELLPOINT SYSTEM
Guarantees Results on Wet Jobs
MORETRENCH CORPORATION
World's Oldest, Largest and Most Experienced Predrainage Organization
Send for Catalog
90 West St., New York 6, N. Y.
Chicago, Ill. Tampa, Fla. Houston, Tex.
Rockaway, N. J.

# CATALOG DIGESTS

### 218 THE COMPLETREATOR

**Dorr-Oliver, Inc.**—An 8-page, two-color bulletin entitled, "The Dorr-Oliver CompleTreator" describes the compact design, operation and advantages of the package-type unit for small plants. Also included in Bulletin #7315, are a line drawing, flow diagram and a series of photographs showing the step-by-step installation of a unit.


PLEASE BE PATIENT

YOUR REQUESTS TAKE TIME


### 219 THE EFFECTS OF CALCIUM CHLORIDE

**Solvay Process Division**—This is a 40-page revision which is of interest to architects, engineers and others concerned with specifications, design or production of cement concrete. The booklet contains a variety of tables, graphs and charts dealing with the setting time, early strength, curing, density, surface wear, shrinkage and ultimate strength. Also shown are effects of varying temperatures and cold weather, and the results with special cements including air-entraining, high early strength and low heat cements.

### 220 THE MARCONI REVIEW

**Marconi's Wireless Telegraph Co. Ltd.**—Devoted to the advancement of the science of radio engineering, this technical journal contains articles on the latest research and development in the fields of radio and electronics. Published quarterly, "The Marconi Review" is written primarily for the laboratory worker and reflects the highest standard of industrial research. The subscription rate is £1.0.0 annually, postage free to any part of the world.

### 221 TIDE GATES

**Brown & Brown, Inc.**—Literature fully describes a complete line of metal tidal gates in 22 circular sizes and 47 rectangular sizes. Also described are timber gates to meet any requirements and a line of cushioned flap gates for use on pump discharge lines. Dimensional and loss of head data are given.

### 222 TRAC-HAMMER

**Vulcan Iron Works, Inc.**—Bulletin TH-1 describes and illustrates the Trac-Hammer, which the company developed with Gardner-Denver Co. This versatile machine combines the outstanding features of the Vulcan Portable Pile Hammer and the Gardner-Denver Air-Trac. The unit offers mobility and ease of handling in a type of equipment heretofore requiring cumbersome and expensive prime movers.

### 223 TRACK-TYPE TRACTORS

**Caterpillar Tractor Co.**—"Built to Beat the ABC" is a new booklet covering the wearability of track-type tractors in underground mining. Such features as full fuel filtering, heavy-duty construction and quality workmanship in Cat equipment are described. On-the-job photos show the crawler-tractors successfully working in adverse underground conditions throughout the world. Illustrated are such special machines as roof bolters, drill jumbos and an electric-powered Traxcavator.

### 224 TRACTOR-DOZER

**The Eimco Corp.**—Bulletin L1049 describes the 105 Tractor-Dozer. Some of its features include visibility and maneuverability, simple, easy controls, unidrive transmission, and the front idlers are of solid construction. Photographs and specifications are also contained in the brochure. Bulletins L1048 and L1050 are also available on the 105 Tractor-Excavator and the 105 Front End Loader. Both brochures contain photographs and specifications.

### 225 TRACTOR SHOVELS

**Allis-Chalmers Mfg. Co.**—Operating, performance and maintenance advantages provided by HD-16G and HD-21G tractor shovels are told through pictures and story in an 8-page, 2-color catalog now available. Also included are engineering, design and construction features of these two models, which, with aforementioned advantages, provide the big capacity, cost-cutting and versatility users want and demand in their equipment.

### 226 TRANSITE® PIPE

**Johns-Manville Corp.**—The installation, operation and maintenance economies of Transite® Pipe and the Ring-Tite® Coupling for pressure water lines are described and illustrated in four pieces of literature offered to engineers. They include DS-335, a material specification; TR-15A, a Friction Loss of Head and Flow Powergraph; TR-62A, an Installation Guide; and TR-160A, in service characteristics and case histories of Transite Water Pipe. Tables of weights, sizes and pressure classes are also included.

### 227 TRANSITE® PIPE

**Johns-Manville Corp.**—Transite® Sewer Pipe, made of asbestos-cement, available in 11 different diameters ranging from 6 in. to 36 in. and in 5 new crushing strengths to permit greater efficiency in system design. Ring-Tite® Coupling, designed for high-speed assembly, provides tight, long-lasting seal. Easy-to-assemble Transite sewer fittings with Ring-Tite assembly also furnished. Complete information is available from brochures TR-165A (Transite Sewer Pipe), TR-94A (Sewer Design Flow Chart), and DS-366 (Transite Specifications).


PHOENIX BRIDGE COMPANY

Engineers
Fabricators
Erectors

Structural Steel
BRIDGES and BUILDINGS

General Office and Shops

PHOENIXVILLE, PA.

Subsidiary—Berium Steel Corporation

In the field of
HYDRAULIC DREDGING

GAHAGAN

a leading name for over 50 years

Gahagan Dredging Corporation,
90 Broad Street, New York 4, N.Y.
Write, wire, or phone Whitehall 3-2558. Cable "Waigahagan".

Pocket Size—Loose Leaf
LEFAX
TECHNICAL DATA BOOKS
$1.25 each

Printed on loose leaf, 6¾" x 3¾" bond paper, each book contains about 140 pages of technical data, condensed, accurate, essential for engineer, technical worker, student, business man.

Architecture
Electrician's Data
Builder's Data
Air Conditioning
Building Constr.
Surveying
Surveying Tables
Highway Eng'g
General Math
Math Tables
Physics
Trig-Log Tables
Gen'l Chemistry
Chemical Tables
Analytic Chem.
Mech'l Drawing
Machine Design
Mech. of Materials
Pwr. Trans. Mach.
Thermo. Tbls. & Charts
Phys. & Thermo. Data
Metals
Metallurgy
Hydraulics
Radio
Television & FM
AC Motors & Gen'trs
Transformers, Relays & Meters

Write for FREE catalog (2000 listings). See how helpful LEFAX can be to you. Send $1.25 book, or $6 for any five books to LEFAX.

ENGINEERING FORMULAS & TABLES: Contains 396 pages of basic formulas, design data and tables, for the 3 branches of engineering—Civil, Mechanical, electrical. Condensed, indexed, accurate. In Sim. leather cover loose leaf, Binder $4.75.

LEFAX PUBLISHERS
DEPT. CE-49, PHILADELPHIA 7, PA.

# CATALOG DIGESTS

### 228 TRANSITS AND DUMPY LEVELS

**Texas-Asiatic Import Co.**—This literature describes the Eagle 6-in. Standard Transits (20-sec and 1-min horizontal verniers), which are made of solid bronze, with a unique 11-piece optical system and several refinements not found on any other instrument. It also describes the Eagle Engineer's Dumpy Levels, which are available in both an 18-in. and 15-in. model.

### 229 TRI-ACETATE SHEETS

**Stanpat Company**—circular describing their printed adhesive-backed acetate sheets for speeding up drafting is available. These sheets are attached to original drawings and save draftsmen from redrawing standard details and repetitive notes. Resulting prints are clear and sharp and save tremendous amount of time.

### 230 TRUE MERIDIAN IN DEFENSE PLANT

**Kern Instrument Inc.**—Civil Engineers reprint describes the use of a Kern Theodolite to solve the difficult problem of establishing a true meridian inside of a defense plant for testing of weapons components.

In filling out the coupon, please print clearly and be sure that you furnish a complete address.

### 231 "T-1" STEEL

**Lukens Steel Co.**—A description of Lukens "T-1" steel, its properties, uses, and fabrication techniques is included in a brochure.

### 232 TUBULAR CONCRETE FILLED COLUMNS

**Tubular Products, Inc.**—An 8-page booklet is available on concrete filled pipe columns and square and rectangular tube columns. Structurally the most efficient, the round concrete filled column is also the most economical since it does not require boxing for use in open areas. Concrete filled columns in square and rectangular form are particularly well adapted to buildings with large window areas; they act in the dual role of structural support and window mullion.

### 233 TUFF TITE CONSTRUCTION FASTENERS

**Townsend Co.**—The company has applied its basic Tuff Tite product design for roofing and siding fasteners to develop a complete line. Latest literature provides information on Tuff Tite screws and bolts, incorporating the proven preassembled conical shaped neoprene washer, which are now available in specific styles and variations for attaching asbestos, protected metal, ceramic coated, aluminum, steel, and fiberglas-plastic sheets and curtain wall.

### 234 TUNNEL AND MINE EQUIPMENT

**Posey Iron Works, Inc.**—A bulletin is available which describes and illustrates round conduit forms, full round non-telescopic tunnel forms, adjustable box forms, self-dumping skips, muck bins, man and material cages, and skip guide towers, pertaining to all types of steel forms and shaft equipment for tunnel and mine usage.

### 235 TUNNELS

**Spencer, White & Prentis, Inc.**—"Famous Subways and Tunnels of the World," by Edward and Muriel White recounts the fascinating history of subways and tunnels from earliest times. The price is $2.75.

N. B. There is a charge for this book. Make checks payable to Spencer, White & Prentis, Inc.

### 236 TWO COMPACTING UNITS IN ONE

**Galion Iron Works & Mfg. Co.**—Bulletin No. 423 presents Galion's combination 3-Wheel Roller with Jackson Electric Vibratory Compactor. It shows how you get the compressing action of massive roller weight plus the consolidating action of vibration. It is claimed this unit is so effective that density specifications such as Proctor, Modified Proctor, and AASHO-T99-49 are often attained in one pass per lift.

### 237 TYLOX RUBBER GASKETS

**Hamilton Kent Mfg. Co.**—A 16-page booklet entitled "Specify Tylox Rubber Gaskets" describes and illustrates with distinct photographs a few of the many installations where the flexible, leak-proof and root-proof gaskets have done their job even under the most adverse pipe laying conditions.

### 238 UNDERGROUND PIPE SYSTEMS

**American Gilsonite Co.**—Some of the articles contained in the Winter 1959 issue of Pipe Insulation News are: Esso Research Center, the cover story, describing the piping system at the new, modern research center and tells the role of Gilsulate in insulating and protecting the underground steam pipes; Bagged to be Buried, which points out the recognition and acceptance of Gilsulate in more than 30 countries around the world; and Gilsulate At Your Service, which offers a new, informative pocket-size pamphlet describing nature and uses of Gilsulate.

### 239 UNDERPINNING

**Spencer, White & Prentis, Inc.**—"Underpinning," a book by Edmund Astley Prentis and Lazarus White is recognized as the authoritative source for information in the field by engineers, architects and contractors all over the world. The price is $10.

N. B. There is a charge for this book. Make checks payable to Spencer, White & Prentis, Inc.

### 240 UTILITY TRACTORS

**Allis-Chalmers Mfg. Co.**—A pictorial review of the D-Series Utility tractors highlights a 6-page catalog, UT-103. Engineering, design and construction features are explained. Specifications and dimensions of the D-14 and D-17 tractors are included. Another catalog, UT-105, is a 12-page 2-color piece which emphasizes the versatility of the D-Series tractors. Sketches show the variety of jobs that can be done quickly and economically with utility tractors and companion equipment.

### 241 VAPOR SEAL MANUAL

**W. R. Meadows, Inc.**—A manual has been prepared covering practical application of the "premoulded Membrane" Vapor Seal. This booklet covers architectural and engineering data, technical information, various applications and specifications.

### 242 VERTICAL PUMPS

**Johnston Pump Co.**—This catalog contains 392 pages of information on vertical pumps. It includes a wealth of information on all phases of the business, including technology, applications, engineering, etc. This book originally sold for $10 per copy but is now being offered free, in limited quantities, to qualified professional people, in connection with the company's 50th Anniversary.


NOW! FASTER TESTS
. . . MORE TESTS . . .

. . . WITH
THE SAME
MANPOWER!

WASHINGTON
Dens-o-meter

THE KEY TO ACCURATE FIELD TESTS FOR MOISTURE-DENSITY IN EMBANKMENT AND FOUNDATION SOILS.

*The DENS-O-METER is light in weight, compact, very portable, easy and economical to operate and maintain!*

Developed after years of research by Department of Highways, State of Washington. Opens up entirely new possibilities for foundation and soils engineers and contractors who can now make accurate moisture-density and compaction tests, quickly and easily.

- in small or large holes up to 3 ft. deep
- in all types soils and granular base materials
- in approximately 3 minutes after hole is dug

CONTRACTORS AND ENGINEERS: Stop over-compaction, under-compaction . . . make moisture-density determinations many times daily with a DENS-O-METER.

GET FULL INFORMATION FROM EXCLUSIVE SALES AGENTS

Charles R. Watts Co.
4121 Sixth Avenue Northwest
Seattle 7, Washington

MAYO

PNEUMATIC GROUTER and "PEA SHOOTER"

Simple to Operate Highly Efficient

The Mayo Grouter quickly and easily places low-pressure grout in tunnels, mines, shafts, foundations, and subgrades. It also may be used to inject sodium silicate emulsions for stabilizing caving or running ground.

This versatile piece of equipment can readily be converted to a "Pea Shooter" for shooting Pea or "Bird's Eye" gravel back of liner plates and back-packing outside lagging plates.

*Write for Free Catalog 13 for full details and specifications.*

MAYO
TUNNEL AND MINE EQUIPMENT
LANCASTER, PENNA.

For CIVIL ENGINEERS

THE BRUNTON* POCKET TRANSIT

**IT'S HANDY...**
weighs only 9 oz.; 2¾" x 3" x 1⅛"; easy to carry in pocket, on belt, in car.

**IT'S VERSATILE...**
ideal for preliminary and supplementary surveying; used as a compass, transit, level, plumb, alidade, clinometer. Shows direction to 1°; level, slope or grade within 1°.

**IT'S MADE TO LAST A LIFETIME**
"Over 60,000 Brunton Transits since 1896"

*See your local engineering supply house or WRITE FOR CATALOG*

*Brunton is a registered trademark of

WM. AINSWORTH & SONS, INC.
3151 LAWRENCE ST. • DENVER 5, COLORADO

# CATALOG DIGESTS

### 243 VERTICAL WATER WELL

**Ranney Method Water Supplies, Inc.**—The newest development in the vertical waterwell field is the subject of this brochure. Called the Vertube, it is a natural gravel vertical water well, designed exclusively for low volume users, at low cost. A diagram of the well completes the brochure.

### 244 VIBRATORY EQUIPMENT CATALOG

**Jackson Vibrators, Inc.**—Multiple Compactors for maximum consolidation of sub-base courses in macadam construction, fills, etc. Manually guided Compactors for paving blacktop walks, drives, pavement patching, widening, consolidation of granular soils in trenches, close to abutments, concrete floor sub-bases, etc.; Concrete Vibratory Screeds; Vibratory Tubes for Internal and Surface Vibration in Concrete Paving; General Construction Vibrators; Portable Power Plants.

### 245 VISQUEEN FILM

**Visking Co., Division of Union Carbide Corp.**—Some of the advantages of Visqueen Film contained in a new pamphlet are: light weight and strong, it resists puncturing and will not shatter or run; it does not get brittle in low temperatures; it will not absorb moisture or mildew; and it can be used as a rain blanket or equipment and material cover.

### 246 VITRIFIED CLAY PIPE

**Gladding, McBean & Co., Pipe Products Div.**—A 6-page catalog sheet, A.I.A. 29-B-5, is available on Yellow Joint Speed-Seal Mainline, the vitrified clay pipe with factory-made, mechanical-compression joints. In addition to outlining the advantages of using Speed-Seal Mainline, the attractive two-color sheet contains suggested specifications as well as recommendations for installation and handling the pipe.

### 247 WALK-TOP SURFACING

**American Bitumuls & Asphalt Co.**—"Walk-Top For Sealing and Smooth Surfacing Walks, Drives & Playgrounds" is not the title but best describes the subject covered in this three-color, four-page folder. It contains full details on sealing rough and open-textured pavements on low-traffic areas. The material is presented in "problem-solution" form, with "how-to" information. Also included is data on special sealing for solvent-resistance for such areas as airport hangar and service areas.

### 248 WATER

**Cast Iron Pipe Research Assoc.**—"Water—make sure you'll always have plenty" is a free booklet telling about the water problem. It shows how responsible citizens can acquaint themselves with the needs of their community. It also gives step-by-step outline of action, telling how they can help their officials extend and improve the local water system through more adequate rate structures or financing.

### 249 WATERPROOFING SYSTEM

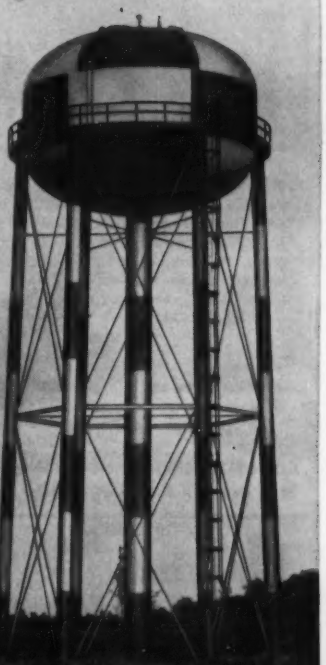
**Brisk Waterproofing Co., Inc.**—Some of the features of the Larson performed waterproofing units included in this brochure are: continuous membrane sealed in wall prevents leaks; high quality of workmanship; durable material; entire wall area protected; furring of wall not a requisite; and strength of wall maintained. Specifications are included.

Return the coupon today!

### 250 WATERPROOFING SYSTEM

**Standard Dry Wall Products, Inc.**—Answers to many of the problems encountered in maintaining, rehabilitating and waterproofing masonry are to be found in this new 20-page booklet. Complete information is offered on sealing basements under pressure, instant stopping of running water leaks, transparent sealers for brick and stone, bonding concrete, etc.

Which Size Is Best for Your Water Supply Requirements?



GRAVER

FABRICATES AND ERECTS ALL SIZES ... FROM 25,000 TO 3,000,000 GALLONS

The Dependable Source

GRAVER TANK & MFG. CO.
DIVISION—UNION TANK CAR COMPANY
EAST CHICAGO, IND.
*Plants and Offices Across America*

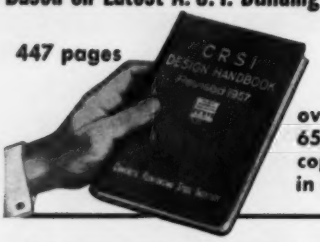
for Elevated Water Tanks

The QUICKEST way to get

**Reinforced Concrete Designs** Revised 1957...

Based on Latest A. C. I. Building Code

447 pages




over 65,000 copies in use

Bring your reference library up to date. Replace your earlier (1952) edition of the CRSI Design Handbook. Completely revised in 1957, this valuable tool will provide you more Reinforced Concrete Designs, all worked out to the latest A.C.I. Building Code. Send check or money order for your copy, today.

Prepared by the Committee on Engineering Practice

$6.00 postpaid

10-Day, Money Back Guarantee

NO C.O.D. ORDERS

CONCRETE REINFORCING STEEL INSTITUTE

38 S. Dearborn St. (Div. F), Chicago 3, Illinois

*For Efficiency and Economy*

•

**LENKER DIRECT READING LEVEL ROD**

•

Every Rod Reading an Elevation

•

No Computations

•

Awarded Medal of Merit for Utility by Franklin Institute of Philadelphia

*Write for Circular*

**LENKER MFG. CO.**

599 CHESTNUT STREET

SUNBURY, PA.

# CATALOG DIGESTS

## 251 WATERSTOP MANUAL

**W. R. Meadows, Inc.**—The availability of a new manual on "Sealtight" PVC Waterstops has been announced. It describes applications, installation information, product specifications and engineering data, and gives complete range of product sizes and types.

## 252 WATER SUPPLIES

**Ranney Method Water Supplies, Inc.**—"Supplying Water for Municipal and Industrial Use," a 24-page catalog, explains how the Ranney Method can provide any type of water program for these uses. Horizontal collectors, infiltration galleries, vertubes, and intakes are fully described. Photographs and schematics depict each operation.

PLEASE PRINT
NAME CLEARLY

## 253 WEATHER ENGINEERING FOR PROFIT

**Weather Corporation of America**—As a growing number of firms have pioneered in the use of today's specialized weather engineering services and because they have demanded more and better interpretative forecasting and deeper research, the role of the consulting meteorologist has become more important. In this booklet, the company presents the case for investigation of its complete services, through the experience record of certain basic industries and an informed projection of that experience into newer uses and fields.

## 254 WELDED HIGHWAY GIRDERS

**The Lincoln Electric Co.**—This 20-page booklet is a condensation of the information on welded girder design and fabrication that is presented at the continuing series of Lincoln Seminars on welded structural design. It discusses how to use steel efficiently in designing the elements and joints of a welded plate girder and how to efficiently fabricate welded girders.

## 255 WELDED STEEL LINE PIPE CATALOG

**Southern Pipe & Casing Co., Div. of U. S. Industries, Inc.**—A new 20-page brochure detailing the facilities, the fabrication processes and the products of the company has been made available to users of welded steel line pipe. Complete details of the new continuous electric resistance welding process are given. The generously illustrated brochure also describes the complete line of protective interior and exterior coatings and linings available.

## 256 WELDED STEEL PIPE

**Bethlehem Steel Co., Inc.**—"Building a Giant Water Line" is a 20-page description in photos and captions of the fabrication and erection of a 14-ft dia steel flow line which replaces a wood-stave line.

## 257 WELL CASING

**Thompson Pipe & Steel Co.**—Some of the subjects which are covered in this 10-page brochure are: black welded well casing, galvanized spot-welded well casing, "special duty" well casing, galvanized riveted well casing, and perforations. Photographs and specifications are included.

## 258 WELLPOINT DEWATERING

**Griffin Wellpoint Corp.**—"How to Handle Wet Jobs," a brochure presenting successful solutions to unusual pre-drainage problems is available.

## 259 WELLPOINT DEWATERING

**Griffin Wellpoint Corporation**—"The Wellpoint System in Principle and Practice" is a handbook of the fundamentals of wellpoint dewatering and is applicable to any wellpoint system regardless of manufacture. It contains information on how a wellpoint system functions, and methods of planning, layout, installation and removal of the system. The manual is pocket size, 109 pp in length and contains 62 diagrams and illustrations. The price is $1.50.

N. B. There is a charge for this book. Make checks payable to Griffin Wellpoint Corporation.

## 260 WELLPOINT DEWATERING SYSTEM

**Griffin Wellpoint Corporation**—A catalog describes the many items of Griffin wellpoint equipment together with pump capacity charts. It contains a series of actual job photographs showing this equipment on various types of construction projects.

## 261 WELLPOINT SYSTEM

**Moretrench Corporation**—an informative 76-page catalog, fully illustrated, describes the Moretrench wellpoint system and its use in dewatering various types of construction projects. It includes useful technical data on the system.

## 262 WIRE BEAM SADDLE

**Universal Form Clamp Co.**—Information is available on a new stirrup type wire beam saddle for forming bridge decks or any concrete slabs over structural steel beams. Designed to provide positive bearing for 2x ledgers or joists, the beam saddle completely eliminates variations in deck elevations due to "biting" of wire into edges of lumber. Beam saddles are fabricated in various sizes to meet job specifications.

## 263 WOOD & STEEL TYPE DOORS

**The Kinnear Mfg. Co.**—The catalog and data book discusses fully and illustrates the advantages, the economy, the construction features and the general specifications of the various types of wood and steel upward-acting type doors. Known as Bulletin 101 it gives information on installation, clearance requirements, methods of operation and controls, as well as adaptability of the doors for many types of uses.

## 264 WROUGHT IRON

**A. M. Byers Co.**—This 8-page booklet discusses 4-D wrought iron, which is 25% more corrosion resistant than standard wrought iron. It includes a graphically illustrated test section which shows the comparative corrosion resistance of 4-D wrought iron, standard wrought iron and other ferrous metals. Three pages are devoted to actual installations, describing applications and service conditions. Data compares service life of wrought iron and other materials under identical environments.

## 265 WROUGHT IRON O.D. PIPING

**A. M. Byers Co.**—This illustrated 8-page booklet outlines wrought iron's suitability for large O.D. applications. It includes service records, typical installations, and an account of the famous Virginia City pipe lines.

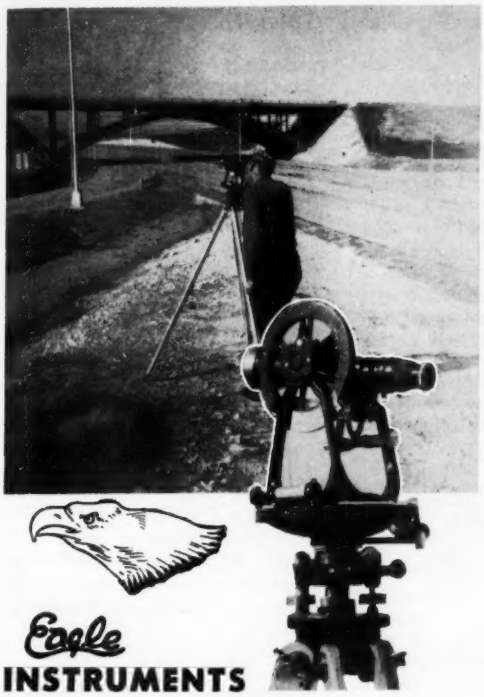
## 266 STEEL FOR POWER PLANTS

**The Ingalls Iron Works Co.**—A major fabricator of structural steel and plate work for power houses, the company has published a brochure which pictures the many different power plants it has fabricated and erected. Ingalls has fabricated steel for 46 major electric power companies.

## 267 SHIPBUILDING CATALOG

**The Ingalls Shipbuilding Corp.**—This 45-page color catalog shows the many different types of vessels built by the company. Among the ships included in this brochure are passenger liners, tankers, cargo vessels, destroyers, and conventional and nuclear submarines. It also contains photographs of offshore submersible drilling barges, service boats, barges of all types, towboats and yachts.

# THE BEST BRIDGES AND TURNPIKES ARE BEING BUILT WITH . . .



Eagle
INSTRUMENTS

*They Fit Best in Your Picture, too!*

While the high cost of domestic labor has priced other surveying instruments out of reason, EAGLE instruments continue to offer the engineer a tool of highest quality, precision and durability at a practical price.

EAGLE instruments continue to outsell all other imported transits, transit levels and Dumpy levels. This cannot be attributed to price alone.

Their popularity is due to the fact that their users know their dependable field performance is matched only by the dependable parts and repair service behind every EAGLE instrument.

The EAGLE dealer nearest you will be glad to show you the complete line of these instruments.

WRITE FOR HIS NAME TODAY!

*U. S. Agents:*

TEXAS-ASIATIC IMPORT CO.
2127 FT. WORTH AVE.
DALLAS 11, TEXAS

*"None more precise — none lower priced!"*

SAW CONCRETE & ASPHALT
*FASTER* WITH THE *ALL-NEW*

Clipper
"SAILS RIGHT THRU"
SELF-PROPELLED
36 H.P. CONCRETE SAW

*Over 36 Outstanding Features Found on No Other Concrete Saw!*

Here is Engineering Leadership by Men Who Know the Concrete Sawing Industry

Other models from 1½ H.P. Gasoline or Electric Priced from **$395**

**BEST BLADES For *Every* Saw *Any* Job!**

Choose from the world's largest selection of Premium Quality Diamond Blades for the Fastest Cutting at the Lowest Cost on any job. Let your Clipper Factory Trained Representative help you select the right Saw and Blades for your job! **Call him Collect Now!**

Mr. Clipper

Genuine Clipper Products Sold Direct—Immediate Shipment From Factory Branches Coast To Coast

**CLIPPER MANUFACTURING CO.**
2806 WARWICK • KANSAS CITY 8, MO. 429X

- ☐ Send Information on Your 36 H. P. CONCRETE SAW
- ☐ Send Information on ALL Models Concrete Saws
- ☐ Send Information on Clipper Premium Quality DIAMOND and GREEN-CON Abrasive Blades
- ☐ Send My Clipper Factory Trained Representative to see me.

NAME _____

ADDRESS _____

CITY _____

STATE _____

# PROCEEDINGS AVAILABLE

## March

**Journals:** Hydraulics, Sanitary Engineering, Waterways and Harbors, Irrigation and Drainage, Structural.

**1960. Calibration of a Submerged Broadcrested Weir, by Richard A. Smith.** (HY) This paper develops coefficients for the standard weir formula, treating the broadcrested weir with control either at the weir or in the tailwater when the weir is flooded or drowned out. For the latter condition, the coefficient varies as a function of the degree of submergence.

**1961. Tabular Solution of Open Channel Flow Equations, by Henry A. Babcock.** (HY) A table is presented by which cubic equations arising in open channel flow problems may be solved without the trial-and-error method. Use of this table is limited to the special case of rectangular channels.

**1962. Relationships Between Pipe Resistance Formulas, by Walter L. Moore.** (HY) The relationship between modern concepts of pipe resistance and older empirical formulas is clarified and an exponential formula applicable to a known range of flow conditions is derived.

**1963. Monthly Consumptive Use Requirements for Irrigated Crops, by Harry F. Blaney.** (IR) Data are presented on measured monthly rates of consumptive water use for irrigated crops in the western United States. A procedure is described for determining consumptive use requirements for crops from climatological data for areas where measurements are not available.

**1964. Drainage of Agricultural Lands Using Interceptor Lines, by William W. Donnan.** (IR) Very few textbooks assist the drainage engineer in designing an interceptor drain line. Some of the theories regarding the function and behavior of an interceptor drain are presented.

**1965. Upstream Irrigation Impact on Columbia River Flows, by Harold T. Nelson.** (IR) Analyses of long-time Columbia River flows at The Dalles, demonstrating magnitude of peak flow reductions and low flow increases due to upstream irrigation are given.

**1966. Investigation of an Artesian Well adjacent to a River, by Verne H. Scott and J. N. Luthin.** (IR) A pump test of an artesian well in a problem area located adjacent to a river is described.

**1967. Characteristics of Reactor Fuel Process Wastes, by J. O. Blomeke, E. D. Arnold, and A. K. Gresky.** (SA) Various types of high-level radioactive wastes produced as effluents from reactor fuel processing plants are examined according to their chemical composition, physical properties, and fission product activity levels.

**1968. Radionuclides in Reactor Cooling Water, by Dade W. Moeller, George W. Leddicotte, and Sam A. Reynolds.** (SA) Studies regarding the identification, source, and control of radionuclides in the recirculating type, cooling water system of the Low Intensity Test Reactor (LITR) at the Oak Ridge National Laboratory are summarized.

**1969. Rivet and Bolt Council Research, by E. J. Ruble.** (ST) The paper presents aims of the council and planning methods, investigations recently completed, and a complete bibliography of published reports is included.

**1970. Strength of Rivets and Bolts in Tension, by W. H. Munse, K. S. Petersen, and E. Chesson, Jr.** (ST) Fastener behavior in a tension-type structural connection was determined. Such factors as flexibility of the connected members, and the magnitude of the initial clamping force are considered, among others.

**1971. Behavior of Riveted and Bolted Beam-To-Column Connections, by W. H. Munse, W. G. Bell, and E. Chesson, Jr.** (ST) The tests reported herein were performed as the first phase of a study of the general behavior of beam-to-column connections assembled with rivets or bolts and including four standard flexible connections.

**1972. Fatigue Tests of Joints of High Strength Steels, by Norman G. Hansen.** (ST) Results of fatigue testing of indirect tension and joints made from structural steels having various properties are presented.

### INSTRUCTIONS

1. Every ASCE member can be registered in two of the Technical Divisions and receive automatically all papers sponsored by those Divisions. **Such registration will be effective 30 days after the receipt of the registration form.**

2. In addition to those papers sponsored by the Divisions in which he is registered, a member is entitled to 100 different papers during a fiscal year beginning October 1.

3. Members' accounts will be charged 25¢ each for additional duplicate copies of a paper and for papers in excess of his free allotment.

4. Papers should be ordered by serial number. The member should keep a record of papers ordered to avoid unwanted duplication.

5. Non-members of the Society may order copies of Proceedings papers by letter with remittance of 50¢ per copy; members of Student Chapters, 25¢ per copy.

**Standing orders for all Papers in any calendar year may be entered at the following annual rates: Members of ASCE, $15.00; members of Student Chapters, $15.00; non-members, $40.00; libraries, $25.00.**

TRANSACTIONS. Specially selected PROCEEDINGS papers with discussions will be included in TRANSACTIONS. Annual volumes of TRANSACTIONS will continue to be available at the current established annual subscription rates.

| | To Members | To Non-Members |
|---|---|---|
| Morocco-grained binding | $4.00 | $18.00 |
| Cloth binding | 3.00 | 17.00 |
| Paper binding | 2.00 | 16.00 |

### KEY TO TECHNICAL DIVISION SPONSORSHIP

(AT) Air Transport
(CP) City Planning
(CO) Construction
(EM) Engineering Mechanics
(HW) Highway
(HY) Hydraulics
(IR) Irrigation and Drainage
(PL) Pipeline
(PO) Power
(SA) Sanitary Engineering
(SM) Soil Mechanics and Foundations
(ST) Structural
(SU) Surveying and Mapping
(WW) Waterways and Harbors
(PP) Professional Practice

**1973. Effects of Fabrication Techniques on Bolted Joints, by Desi D. Vasarhelyi, Said Y. Beano, Ronald B. Madison, Zung-An Lu, and Umesh C. Vasishth. (ST)** Effects of faying surface treatments, of punching and misalinement of holes, and of the tightening by one turn of the nut upon slip and efficiency of structural joints assembled with high tensile bolts are examined.

**1974. Installation and Tightening of High-Strength Bolts, by E. F. Ball and J. J. Higgins. (ST)** Procedures used to insure that high-strength bolts are tightened to produce the minimum bolt tension required by specifications are described and studies developing a practical method of bolt tightening are outlined.

**1975. Experience with High-Strength Bolts in the Mackinac Bridge, by John W. Kinney. (ST)** The particular applications of bolted connections and the procedures for bolting and inspection as developed on the project are outlined.

**1976. Generalities of Coastal Processes and Protection, by J. B. Schijf. (WW)** The engineering basis of coastal protection is reviewed with emphasis on the Dutch seacoast. The paper supports a shift from protection by groins and seawalls to protection by sandfill.

**1977. Tidal Computations in Coastal Areas, by J. J. Dronkers. (WW)** Computation of tidal motion in shallow coastal waters by the harmonic method is presented. Propagation of the tide in Tampa Bay on the coast of Florida is examined.

**1978. Hydraulic Investigations for the Delta Project, by H. A. Ferguson. (WW)** Field observations, office computations, and model studies made of the Delta protection and reclamation project under construction as of 1958 in the Netherlands are described.

**1979. Model Study of a Hydraulic Breakwater over a Reef, by C. M. Snyder. (WW)** Model test results of a combination hydraulic breakwater and submerged breakwater (reef type) are given. Experimental relationships among reef size, jet discharge and wave characteristics are presented.

**1980. Sand By-Passing Plant at Lake Worth Inlet, Florida, by Charles Senour and John R. Bardes. (WW)** Beach erosion in the vicinity of Palm Beach, Florida, is examined with reference to beach starvation, downdrift of the Lake Worth Inlet, and means adopted for its amelioration. A description of a plant for sand bypassing by means of a submerged pipeline is given.

**1981. Oil Loading Terminal, Pakning, Sumatra, by Barnett Silveston. (WW)** This paper describes the wharf and pipeline construction, including the energy-absorbing fender system, and the means employed to protect steel in the structure against corrosion.

**1982. Water Forces on Accelerated Cylinders, by A. D. K. Laird, C. A. Johnson, and R. W. Walker. (WW)** For single horizontal cylinders the drag coefficients during acceleration agreed with uniform motion values, but deviations occurred during deceleration. The acceleration modulus did not correlate the resistance coefficients near boundary layer transitions. A leading parallel cylinder reduced the mean resistance but caused some violent force fluctuations.

**1983. "Tidal" Navigational Problems Below Wilson Dam, by Rex A. Elder. (WW)** Entrance conditions at the mouth of the canal leading to the lock facilities were studied on a 1:100 undistorted model. Special entrance structures were developed alleviating adverse navigational conditions caused by the daily fluctuations in turbine discharge together with the steady flow from the plant and spillway.

**1984. The Hydrology of Urban Runoff, by A. L. Tholin and Clint J. Keifer. (SA)** A study of rainfall-runoff relationships in urban areas based upon a design storm on different types of uniform land use is presented. Design graphs and the effects of variations in areal distribution of rainfall are given.

**1985. Discussion of Proceedings Paper 1337, 1592, 1777, 1780, 1782, 1850. (SA)** W. W. Towne and W. H. Davis closure to 1337. Eugene A. Hardin closure to 1592. Howard M. Turner on 1777, M. B. McPherson, Harold E. Babbitt on 1780. Herbert Moore on 1782. Russell H. Babcock on 1850.

**1986. Discussion of Proceedings Paper 1359, 1497, 1499, 1501, 1507, 1589, 1754. (IR)** David B. Willets and Charles A. McCullough closure to 1359. Harvey O. Banks closure to 1497. Earl Harbeck, Jr., closure to 1499. Samuel B. Morris closure to 1501. Wayne D. Criddle closure to 1507. R. S. Willson closure to 1589. Douglas R. Woodward, Alfred R. Golze, Donald McCord Baker on 1754.

**1987. Discussion of Proceedings Paper 1569, 1571, 1644, 1770, 1772, 1789. (WW)** Russell A. Dilley closure to 1569. Basil W. Wilson corrections to discussion of 1571. P. Bruun and F. Gerritsen closure to 1644. Woodland Gray Shockley, Raymond A. Wheeler, F. K. Morris, Jos. Millecam, James Kip Finch, J. W. Leslie, P. A. Blanquet, R. L. Bostian, Jr., Tsung Lien Chow, W. E. Potter, Arthur B. Cleaves on 1770. Shu Tien Li on 1772. Robert E. Hickson on 1709.

**1988. Discussion of Proceedings Paper 1320, 1560, 1630, 1695, 1707, 1708, 1709, 1710, 1711, 1712, 1722, 1865. (ST)** Eric L. Erickson and Neil Van Eenam closure to 1320. Kurt H. Gerstle closure to 1560. Frederick H. McDonald no closure notice to 1630. Emilio Rosenblueth, M. J. Murphy and R. I. Skinner and K. M. Adams, R. W. Binder on 1695. C. Scruton on 1707. Herbert S. Safir, W. R. Schriever, Donald C. Bunting, R. C. Gentry, A. G. Davenport, Henri Perrin, C. Scruton on 1708. C. Scruton, Henri Perrin on 1709. C. Scruton, Henri Perrin on 1710. C. Scruton, Henri Perrin on 1711. C. Scruton on 1712. Alexander Dodge corrections to discussion of 1722. Tung Au on 1865.

**1989. Discussion of Proceedings Paper 1453, 1530, 1588, 1808, 1809, 1833. (HY).** Carl E. Kindsvater and Rolland W. Carter closure to 1453. Emmett M. Laursen closure to 1530. M. B. McPherson and J. V. Radziul closure to 1588. Ven Te Chow, J. L. H. Paulhus on 1808. Ven Te Chow on 1809. Turgut Sarpkaya on 1833.


**ORDER FORM FOR PROCEEDINGS**

***(For ASCE member use only)***

To obtain complete Journals or reprints of the papers listed here, complete the mailing label below, write in the Journal name or paper numbers desired, cut it from this section, insert the label in an envelope, and mail to ASCE, 33 West 39th St., N.Y. 18, N.Y. Please make the mailing label legible—correct delivery is up to you.

Name .....Membership Grade.....

Address .....

City .....Zone.....State.....

Papers:

*Journals (at a cost of $1.50 each):*

# PROFESSIONAL SERVICES

Listed alphabetically by areas, states, cities and names

## EASTERN

**AIRPORT FUELING SYSTEMS, INC.**

Specialists in Design of Liquid Handling Systems.

**1212—18th Street, N.W.**
**Washington 6, D. C.**

**KNOERLE, GRAEF, BENDER & ASSOCIATES, INC.**

*Consulting Engineers*

Highways, Bridges, Airports, Water-front Structures

**210 N. Calvert St., Baltimore 2, Maryland**
**155 North Wacker Dr., Chicago 6, Illinois**

**WHITMAN, REQUARDT AND ASSOCIATES**

*Engineers*

Sewerage and Water Systems, Highways Airports, Industrial and Power Plants and Other Structures
Reports • Designs • Specifications • Supervision

**1304 St. Paul Street Baltimore 2, Md.**

**MADDOX AND HOPKINS**

*Engineers and Surveyors*

Plane and Geodetic Surveys
Topographic Maps • Photogrammetry
Highways, Utilities, Structures

**8506 Dixon Ave. Silver Spring, Md.**

**CLARKESON ENGINEERING COMPANY, INC.**

Highways, Bridges, Structures, Airports, Dams, Traffic Surveys, Reports, Waterfront Facilities

**285 Columbus Avenue, Boston 16, Massachusetts, Suite 200, 2000 P St. NW, Washington 1, D. C.**

**FAY, SPOFFORD & THORNDIKE, INC.**

*Engineers*

Airports, Bridges, Express Highways
Water Supply, Sewerage and Drainage
Port and Terminal Works, Industrial Bldgs.
Incinerators and Power Plants

**Boston, Massachusetts**

**JACKSON & MORELAND, INC. JACKSON & MORELAND INTERNATIONAL, INC.**

*Engineers and Consultants*

Electrical • Mechanical • Structural
Design and Supervision of Construction for
Utility, Industrial and Atomic Projects
Surveys • Appraisals • Reports
Machine Design • Technical Publications

**Boston—New York**

**METCALF & EDDY**

*Engineers*

Investigations Reports Design
Supervision of Construction and Operation
Management Valuation Laboratory

**Statler Building • Boston 16**

**The Thompson & Lichtner Co., Inc.**

*Civil and Industrial Engineers*

Design, Supervision, Testing, Engineering and Production Studies
Special Structures, Tunnels, Airports, Highways, Foundations

**Office and Laboratory • Brookline, Mass.**

**CRANDALL DRY DOCK ENGINEERS, INC.**

Railway Dry Docks, Floating Dry Docks, Basin Dry Docks, Shipyards, Port Facilities
Investigation, Reports, Design

**238 Main St. Cambridge 42, Mass.**

**GOODKIND & O'DEA**

*Consulting Engineers*

Design and Supervision
Foundations, Structures, Highways

**610 Bloomfield Ave., Bloomfield, N. J.**
**1214 Dixwell Avenue, Hamden, Conn.**
**325 Spring Street, New York, New York**
**7956 Oakton Street, Chicago 31, Illinois**

**JOSEPH S. WARD**

*Consulting Soil and Foundation Engineer*

Site Investigation, Boring Supervision, Laboratory Soil Testing, Foundation and Pavement Analysis and Design, Construction Supervision, Engineering Reports and Consultation

**91 Roseland Avenue Caldwell, N. J.**

**GREER ENGINEERING Associates**

*Soils Engineers*

Site Investigations; Foundation Analyses for Buildings, Bridges, Airports, Highways, Earth Dams, Pavements; Field Inspection; Laboratory and Field Testing for all types of Earthwork.

**98 Greenwood Avenue, Montclair, N. J.**

**EDWARDS AND KELCEY**

*Engineers and Consultants*

Highways—Structures
Traffic—Parking
Terminal Facilities

**3 William Street, Newark 2, New Jersey**
**Boston New York**
**Salt Lake City Minneapolis**

**PORTER, URQUHART, McCREARY & O'BRIEN**
**O. J. Porter & Co.**

*Consulting Engineers*

Airports • Highways • Dams • Structures
Foundations • Stabilization • Pavements

**415 Frelinghuysen Ave., Newark 5, N. J.**
**4201 Sunset Blvd., Los Angeles 29, Cal.**
**1421 47th Ave., Sacramento 22, Cal.**
**1140 Howard St. San Francisco 3, Cal.**

**LOUIS BERGER & ASSOCIATES**

*Consulting Engineers*

Studies Design Supervision
Expressways Airfields
Structures Foundations

**177 Oakwood Ave., Orange, N. J.**
**2nd and Locust Sts. Harrisburg, Penna.**
**200 S. Main Street, Salt Lake City, Utah**
**40 rue du Rhone, Geneva, Switzerland**

**B. K. HOUGH**

*Consulting Engineer*

*Soil and Foundation Engineering*

Site Investigation, Soil Testing, Design Analysis for Earthworks, Foundations and Pavements, Field Inspection, Engineering Reports, Consultation

**121 E. Seneca St. Ithaca, New York**

**FRANK L. EHASZ**

*Consulting Engineers*

Highways, Expressways, Bridges, Buildings, Port Development, Airports, Dams, Flood Control, Tunnels, Sewerage, Water Supply

**40-29 27th Street**
**Long Island City 1, N. Y.**

**AMMANN & WHITNEY**

*Consulting Engineers*

Design and Construction Supervision of Bridges, Highways, Expressways, Buildings, Special Structures, Airport Facilities

**111 Eighth Avenue, New York 11, N. Y.**
**724 E. Mason St., Milwaukee 2, Wisc.**
**1520 Connecticut Avenue, N.W. Washington 6, D. C.**

**ANDREWS & CLARK**

*Consulting Engineers*

305 East 63rd Street
New York 21, N. Y.

**BARSTOW, MULLIGAN & VOLLMER**

*Engineers*

Bridges, Highways, Parks

**49 West 45th Street**
**New York 36, New York**

**BOGERT AND CHILDS**

*Consulting Engineers*

Clinton L. Bogert Fred S. Childs
Ivan L. Bogert Donald M. Ditmars
Robert A. Lincoln Charles A. Manganaro
William Martin

Water and Sewage Works • Refuse Disposal • Drainage • Flood Control • Highways & Bridges • Airfields

**145 East 32nd St., New York 16, N. Y.**

**BOWE, ALBERTSON & ASSOCIATE**

*Engineers*

Sewage and Water Works • Industrial Wastes • Refuse Disposal • Municipal Projects • Industrial Buildings • Reports • Plans Specifications • Supervision of Construction and Operation • Valuation Laboratory Service

**75 West Street New York 6, N. Y.**

**BLAUVELT ENGINEERING CO.**

*Consulting Engineers*

Highways
Bridges
Reports

**468 Fourth Ave. New York 16, N. Y.**

**BUCK, SEIFERT AND JOST**

*Consulting Engineers*

Water and sewage works, industrial wastes disposal, hydraulic developments, dams, flood control. Chemical and biological laboratory.

**112 East 19th Street, New York 3, N. Y.**

**THOMAS CRIMMINS CONTRACTING COMPANY**

*Established 1848*

Difficult Rock Excavation, Heavy Foundations, Caissons and Underpinning

**624 Madison Ave. New York 22, N. Y.**
EL 5-0270

**FARKAS & BARRON**

*Consulting Engineers*

Designs • Supervision • Reports • Highways Expressways • Bridges • Housing • Public, Commercial and Industrial Buildings • Special Structures, Marine Structures • Airports

5 Beekman Street, New York 38, N. Y.
11 Commerce Street, Newark, N. J.
173 West Madison Street, Chicago, Illinois
7 Adelaide Street East, Toronto, Canada

## DIVISION ENROLLMENT FORM

### American Society of Civil Engineers

### 33 West 39th Street, New York 18, New York

☐ I am already enrolled
or
☐ I wish to be enrolled

in the.....
Division and receive automatically the Journal of that Division.

In addition, I wish to be enrolled in the

.....
Division and receive automatically the Journal of that Division.

(Signature)

(Please print name) (Membership grade)

PLEASE PRINT MAILING ADDRESS ONLY

(Number and Street)

(City) (Zone) State

# PROFESSIONAL SERVICES

Listed alphabetically by areas, states, cities and names

**GIBBS & HILL, INC.**
**CONSULTING ENGINEERS**

Water, Sewage & Industrial Waste Treatment Works—Roads, Bridges & Railroads—Conventional & Nuclear Power Generation—Electric Transmission & Distribution Systems—Industrial & Communication Facilities.

**New York 1, N. Y. Pennsylvania Station**
**Los Angeles 14, Calif. 510 W. 6th St.**
**Tampa 1, Fla. 608 Tampa St.**

---

**HARDESTY & HANOVER**

*Consulting Engineers*

Long Span and Movable Bridges, Hanover Skew Bascule, Grade Eliminations, Foundations, Expressways and Thruways, Other Structures, Supervision, Appraisals and Reports

**101 Park Avenue, New York 17, N. Y.**

---

**FREDERIC R. HARRIS, INC.**

*Consulting Engineers*

Economic Surveys and Reports
Engineering Investigations and Reports
Design and Supervision of Construction
Port and Harbor Facilities • Highways, Expressways and Bridges • Power and Industrial Plants • Airport Facilities

**27 William St. 1915 Tulane Avenue**
**New York 5, N. Y. New Orleans, La.**

---

**HAZEN AND SAWYER**

*Engineers*

Richard Hazen Alfred W. Sawyer
H. E. Hudson, Jr.

Water and Sewage Works
Industrial Waste Disposal
Drainage and Flood Control

**122 East 42nd St. 3333 Book Building**
**New York 17, N. Y. Detroit 26, Mich.**

---

**JOHN J. KASSNER & CO**

*Consulting Engineers*

Highways, Bridges, Structures • Sewerage and Drainage • Waterfront Construction Site Engineering and Recreational Facilities Reports, Designs, Contracts and Specifications, Supervision of Construction

**6 Church Street New York 6, N. Y.**

---

**KING & GAVARIS**

*Consulting Engineers*

Bridges, Highways, Tunnels
Waterfront Structures, Reports
Investigations, Foundations
Design & Supervision of Construction

**425 Lexington Ave. New York**

---

**LEGGETTE, BRASHEARS & GRAHAM**

*Consulting Ground Water Geologists*

Water Supply, Salt Water Problems, Dewatering, Recharging, Investigations, Reports

**551 Fifth Avenue, New York 17, N. Y.**

---

**MORAN, PROCTOR, MUESER & RUTLEDGE**

*Consulting Engineers*

Foundations for Buildings, Bridges and Dams, Tunnels, Bulkheads, Marine Structures, Soil Studies and Tests, Reports, Design and Supervision

**415 Madison Ave., New York 17, N. Y.**
Phone: El 5-4800

---

**STEPHEN M. OLKO**

*Consulting Engineers*

Reports and Designs
Soil Mechanics—Foundations
Marinas—Port Facilities
Structures—Highways—Airfields

**50 E. 42 Street, New York 17, New York**
OXford 7-6831

---

**PARSONS, BRINCKERHOFF, HALL & MACDONALD**

*Engineers*

Bridges, Highways, Tunnels, Airports, Subways, Harbor Works, Dams, Canals, Traffic, Parking and Transportation Reports, Power, Industrial Buildings, Housing, Sewerage and Water Supply

**165 Broadway New York 6, N. Y.**

---

**E. LIONEL PAVLO**

*Consulting Engineer*

Design, Supervision, Reports
Bridges, Highways, Expressways
Marine Structures, Industrial Construction
Public Works, Airports

**642 Fifth Avenue New York 19, N. Y.**

---

**MALCOLM PIRNIE ENGINEERS**

**Malcolm Pirnie Ernest W. Whitlock**
**Robert D. Mitchell Carl A. Arenander**
**Malcolm Pirnie, Jr.**

MUNICIPAL AND INDUSTRIAL
Water Supply—Water Treatment
Sewage and Waste Treatment
Drainage • Sewerage • Refuse Disposal

**25 West 43rd Street, New York 36, N. Y.**

---

**THE PITOMETER ASSOCIATES, INC.**

*Engineers*

Water Waste Surveys
Trunk Main Surveys
Water Distribution Studies
Water Measurement and Special Hydraulic Investigations

**New York, 50 Church St.**

---

**ALEXANDER POTTER ASSOCIATES**

*Consulting Engineers*

Water Works Sewerage, Drainage, Refuse Incinerators, Industrial Wastes, City Planning

**50 Church Street New York 7, N. Y.**

---

**PRAEGER • KAVANAGH**

*Engineers*

**126 East 38th St. New York 16, N. Y.**

---

**SEELYE STEVENSON VALUE & KNECHT**

*Consulting Engineers*

Richard E. Dougherty, Consultant

Civil—Structural
Mechanical—Electrical

**101 Park Avenue New York 17, N. Y.**

---

**SEVERUD • ELSTAD • KRUEGER • ASSOCIATES**

*Consulting Engineers*

Structural Design • Supervision • Reports
Buildings • Airports • Special Structures

**415 Lexington Ave., New York 17, N. Y.**

---

**SINGSTAD & BAILLIE**

*Consulting Engineers*

**Ole Singstad David G. Baillie, Jr.**

Tunnels, Subways, Highways, Foundations, Parking Garages
Investigations, Reports, Design
Specifications, Supervision

**24 State St. New York 4, N. Y.**

---

**FREDERICK SNARE CORPORATION**

*Engineers • Contractors*

Harbor Works, Bridges, Power Plants
Dams, Docks and Foundations

**233 Broadway, New York 7, N. Y.**
**Havana, Cuba Lima, Peru**
**Bogota, Colombia Caracas, Venezuela**

---

**D. B. STEINMAN**

*Consulting Engineer*

**BRIDGES**

Design, Construction, Investigation, Reports, Strengthening, Advisory Service

**117 Liberty Street, New York 6, N. Y.**

---

**TIPPETTS • ABBETT • McCARTHY • STRATTON**

*Engineers*

Ports, Harbors, Flood Control Irrigation
Power, Dams, Bridges, Tunnels
Highways, Railroads
Subways, Airports, Traffic, Foundations
Water Supply, Sewerage, Reports
Design, Supervison, Consultation

**62 West 47th Street, New York City**

---

**LAWRENCE S. WATERBURY**

*Consulting Engineer*

**26 Broadway**
**New York 4, N. Y.**
Bowling Green 9-9298

---

**THE J. G. WHITE ENGINEERING CORPORATION**

*Engineers and Constructors*

**80 Broad St., New York 4, N. Y.**

---

**JOHN M. MUDDEMAN ASSOCIATES**

*Consulting Engineers*

**Stony Brook and Seaford, Long Island, N. Y.**

City and Town Planning
General Municipal Engineering
Main Office: P. O. Building
Stony Brook, N. Y.

---

**LOCKWOOD, KESSLER & BARTLETT, INC.**

*Engineers* *Surveyors*

Civil Engineering Investigations, Reports and Designs, Supervision of Construction, Seismic Subsurface Investigation, Cadastral, Geodetic, Topographic & Engineering Surveys Photogrammetric Engineering and Mapping

**One Aerial Way Syosset, New York**

---

**YULE, STICKLEN, JORDAN & McNEE**

*Engineers*

Highways, Bridges, Airports
Design, Investigations, Reports
Supervision of Construction
Civil, Structural, Mechanical, Electrical

**23rd and Markets 309 South Broad St.**
**Camp Hill, Pa. Philadelphia 7, Pa.**
**5564 North High St.**
**Columbus, Ohio**

---


## *Sewage Treatment Plant Design*

A joint ASCE-FSIWA committee has worked for several years to produce the latest in the series of Manuals of Engineering Practice. Copies of this manual can be obtained by completing the accompanying coupon. The list price is $7.00 and ASCE members are entitled to a 50% discount. In cloth binding, $1.00 additional, net.

---------- CUT HERE ----------

**American Society of Civil Engineers**
**33 West 39th Street, New York 18, N. Y.**

Please send me.....copy(s) of Manual 36 (in cloth binding). Enclosed is my remittance of $.....My ASCE membership grade is.....

---

*Print Name*

*Address*

*City* *Zone* *State*

. . . of M36

# PROFESSIONAL SERVICES

Listed alphabetically by areas, states, cities and names

**CAPITOL ENGINEERING CORPORATION**
*Consulting Engineers*
Design and Surveys • Roads and Streets
Sewer Systems • Water Works
Planning • Airports
Bridges • Turnpikes • Dams
*Executive Offices*
**Dillsburg, Pennsylvania**
**Washington, D. C** **Pittsburgh, Pa.**
**Rochester, N. Y.** **Saigon, Vietnam**

**GANNETT FLEMING CORDDRY & CARPENTER, INC.**
*Engineers*
Dams, Water Works, Sewage, Industrial Waste and Garbage Disposal • Highways Bridges and Airports, Traffic and Parking • Appraisals, Investigations, and Reports
**HARRISBURG, PENNA.**
**Pittsburgh, Pa.** **Philadelphia, Pa.**
**Daytona Beach, Fla.**

**MODJESKI AND MASTERS**
*Consulting Engineers*
**F. M. Masters**
**G. H. Randall** **J. R. Giese**
**C. W. Hanson** **H. J. Engel**
Design and Supervision of Construction
Inspection and Reports
Bridges, Structures and Foundations
**P.O. Box 167** **Philadelphia, Pa.**
**Harrisburg, Pa.** **New Orleans, La.**

**AERO SERVICE CORPORATION**
Integrated surveying and mapping services—including soils and sub-surface studies—for Highways, Water Supply, Dams, Airports, Municipal Developments, and other large engineering projects. Also associated electronic computing services.
**210 E. Courtland St., Philadelphia 20, Pa.**

**ALBRIGHT & FRIEL INC. CONSULTING ENGINEERS**
Water, Sewage, Industrial Wastes and Incineration Problems, City Planning, Highways, Bridges and Airports, Dams, Flood Control, Industrial Buildings, Investigations, Reports, Appraisals and Rates
**Three Penn Center Plaza**
**Philadelphia 2, Pa.**

**LAWRENCE T. BECK AND ASSOCIATES**
*Engineers and Consultants*
**Philadelphia** **New York** **Washington**

**JUSTIN & COURTNEY**
*Consulting Engineers*
**Joe W. Justin** **Neville C. Courtney**
Dams and Power Problems
Hydro Electric Developments
Foundations
**121 S. Broad St.** **Philadelphia 7, Pa.**

**H. A. KULJIAN & COMPANY**
*Engineers and Architects*
Power Plants (steam, hydro, diesel) Industrial Buildings • Army & Navy Installations • Airports, Hangars Water and Sewage Works
Design • Investigations • Reports • Surveys
**1200 No. Broad St.** **Phila. 21, Pa.**

**HUNTING, LARSEN & DUNNELLS**
*Engineers*
Industrial Plants • Warehouses
Commercial Buildings • Office Buildings
Laboratories • Steel and Reinforced Concrete Design • Supervision
Reports
**1150 Century Bldg., Pittsburgh 22, Pa.**

**MORRIS KNOWLES INC.**
*Engineers*
Water Supply and Purification
Sewerage and Sewage Disposal
Valuations, Laboratory, City Planning
**1312 Park Bldg.,** **Pittsburgh 22, Pa.**

**PENNSYLVANIA DRILLING COMPANY**
Subsurface Explorations. Grouting
Industrial Water Supply. Mineral Prospecting
Large Diameter Drilled Shafts
Reports
**1205 Chartiers Ave.** **Pittsburgh 20, Pa.**

**GILBERT ASSOCIATES, INC.**
*Engineers and Consultants*
Surveys • Design • Supervision
Sanitary Engineering
Industrials and Utilities
Domestic and Foreign
**525 Lancaster Avenue, Reading, Pa.**
**New York • Washington**

**MICHAEL BAKER, JR., INC.**
**The Baker Engineers**
*Civil Engineers, Planners, and Surveyors*
Airports, Highways, Sewage Disposal Systems, Water Works Design and Operation, City Planning, Municipal Engineering, All Types of Surveys
**Home Office: Rochester, Pa.**
*Branch Office*
**Jackson, Miss.** **Harrisburg, Pa.**

**SPRAGUE & HENWOOD, INC.**
Foundation Investigations • Soil Testing and Test Borings • Grout Hole Drilling and Pressure Grouting • Diamond Core Drilling
**Scranton, Pa.** **New York, N. Y.**
**Philadelphia, Pa.** **Grand Junction, Colo.**
**Pittsburgh, Pa.** **Atlanta, Georgia**
**Buchans, Newfoundland**

**BUCHART ENGINEERING CORP.**
*Consulting Engineers*
Highways—Bridges—Sewer Systems—Surveys—Water Works—Dams—Reports—Supervision—Industrial—Municipal—Structures
**55 S. Richland Ave., York, Pa.**
**Lancaster, Pa.** **Washington, D. C.**

**C. W. RIVA CO.**
**Edgar P. Snow** **John F. Westman**
Highways, Bridges, Tunnels, Airports, Sewerage, Water Supply, Soil Tests, Reports, Design and Supervision
**Great Neck, N. Y.** **Prov. 3, R. I.**
**No. Attleboro, Mass.**

## MID-WESTERN

**ALVORD BURDICK & HOWSON**
*Consulting Engineers*
Water Works, Sewerage, Water Purification, Sewage Treatment, Flood Relief, Power Generation, Drainage, Appraisals
**20 North Wacker Drive, Chicago 6, Ill.**

**CONSOER, TOWNSEND & ASSOCIATES**
Water Supply, Sewerage, Flood Control and Drainage, Bridges, Express Highways, Paving, Power Plants, Appraisals, Reports, Traffic Studies, Airports, Gas and Electric Transmission Lines
**360 E. Grand Ave., Chicago 11, Illinois**
**9½ Indiana St. Greencastle, Ind.**

**GREELEY AND HANSEN**
Water Supply, Water Purification, Sewerage, Sewage Treatment, Refuse Disposal, Industrial Wastes
**220 S. State Street, Chicago 4, Illinois**

**DeLEUW, CATHER & COMPANY**
*Consulting Engineers*
Public Transit — Subways
Traffic & Parking — Railroad Facilities
Expressways — Industrial Plants
Grade Separations — Municipal Works
Urban Renewal — Port Development
**150 North Wacker Drive, Chicago 6**
**San Francisco Toronto Oklahoma City**

**HARZA ENGINEERING COMPANY**
*Consulting Engineers*
**Calvin V. Davis** **E. Montford Fucik**
**Richard D. Harza**
Hydroelectric Plants and Dams
Transmission Lines
Flood Control, Irrigation
River Basin Development
**400 West Madison Street** **Chicago 6**

**C. MARTIN RIEDEL**
*Consulting Engineer*
Chemical Soil Solidification Engineering for
Tunnels, Shafts, Mines, Foundations
Underground Structures
**7650 S. Laflin St.** **Chicago 20, Illinois**
**29-27 41st Ave., Long Island City 1, N.Y.**

**SOIL TESTING SERVICES, INC.**
*Consulting Engineers*
John P. Gnaedinger — Carl A. Metz
Sub-Surface Investigations, Laboratory testing, Inspection, Engineering Reports And Design of Foundations
**1827 No. Harlem Ave., Chicago 35, Ill.**
**Kenilworth, N. J.—San Francisco, Calif.**
**Vedado Hana, Cuba**

**STANLEY ENGINEERING COMPANY**
*Consulting Engineers*
**208 S. LaSalle Street** **Hershey Building**
**Chicago 4, Illinois** **Muscatine, Iowa**

**JENKINS, MERCHANT & NANKIVIL**
*Consulting Engineers*
Municipal Improvements — Gas Systems
Highways & Airports — Water Systems
Power Development — Sewerage Systems
Traffic Surveys — Industrial Plants
Flood Control — Recreational Facilities
Investigations and Reports
**801-805 East Miller St.** **Springfield, Ill.**

**CLARK, DAILY & DIETZ**
*Consulting Engineers*
James G. Clark — Jess C. Dietz
Eugene J. Daily — W. Don Painter
Expressways • Structures • Sanitary • Civil
**211 N. Race, Urbana, Illinois**
**188 Jefferson, Memphis, Tennessee**

**NED L. ASHTON**
*Consulting Engineer*
Aluminum and Steel Structures
Bridges and Paraboloidal Antennas
Swimming Pools and Foundations
Welded Design and Strengthening
**820 Park Road** **Iowa City, Iowa**

**WALLACE & HOLLAND**
*Consulting Engineers*
Civil — Sanitary — Structural
**401 N. Federal** **Mason City, Iowa**

**SERVIS, VAN DOREN & HAZARD**
Engineers-Architects
Investigations • Design • Supervision of Construction—Appraisals
Water • Sewage • Streets • Expressways
Highways • Bridges • Foundations • Airport
Flood Control • Drainage • Aerial Surveys
Site Planning • Urban Subdivisions
Industrial Facilities • Electrical • Mechanical
**2910 Topeka Blvd.** **Topeka, Kansas**

**BLACK & VEATCH**
*Consulting Engineers*
Water, Sewage, Electricity, Industry, Reports, Design Supervision of Construction Investigations, Valuation and Rates
**1500 Meadow Lake Parkway**
**Kansas City 14, Missouri**

**BURNS & McDONNELL**
*Engineers • Architects • Consultants*
**Kansas City, Missouri • P.O. Box 7088**
Phone: DElmar 3-4375

**HOWARD, NEEDLES, TAMMEN & BERGENDOFF**
*Consulting Engineers*
Bridges, Structures, Foundations
Express Highways
Administrative Services
**1805 Grand Avenue** **99 Church Street**
**Kansas City 6, Mo.** **New York 7, N. Y.**

**SVERDRUP & PARCEL ENGINEERING CO.**
*Engineers • Architects*
Bridges, Structures and Reports
Industrial and Power Plant Engineering
**915 Olive Street, St. Louis 1, Mo.**
**417 Montgomery Street, San Francisco 4, Cal.**

**A. L. ALIN**
*Consulting Engineer*
**5927 N. 24 Street**
**Omaha 10, Nebraska**
Dams, Hydroelectric Power
Flood Control

**HAZELET & ERDAL**
*Consulting Engineers*
Design, Supervision, Investigations, Reports
Fixed Bridges — Movable Bridges
Expressway Systems — Harbor Works & Dams
**Dixie Terminal Bldg., Cincinnati 2, O.**
**Monadnock Block, Chicago 4, Ill.**
**Oding Bldg., Lansing 33, Mich.**
**Commerce Bldg., Louisville 2, Ky.**

# PROFESSIONAL SERVICES

Listed alphabetically by areas, states, cities and names

**VOGT, IVERS, SEAMAN & ASSOC.**
*Engineers-Architects*
Highways — Structures — Expressways
Industrial Bldgs. — Harbor Facilities
Airports — Dams — Docks
Surveys — Reports
**34 W. Sixth St., Cincinnati 2, O.**
**20 N. Wacker Dr., Chicago 6, Ill.**

**THE AUSTIN COMPANY**
Design • Construction • Reports • Plant Location Surveys • Domestic and Foreign Work
**16112 Euclid Avenue, Cleveland, Ohio**
**New York Detroit Oakland**
**Chicago Houston Seattle**
**Los Angeles**

**HAVENS AND EMERSON**
**A. A. Burger H. H. Moseley**
**J. W. Avery F. S. Palocsay**
**E. S. Ordway G. H. Abplanalp**
**A. M. Mock S. H. Sutton**
**Frank C. Tolles, Consultant**
*Consulting Engineers*
Water, Sewerage, Garbage, Industrial Wastes, Valuation, Laboratories
**Leader Bldg. Woolworth Bldg.**
**Cleveland 14, O. New York 7, N. Y.**

**THE OSBORN ENGINEERING COMPANY**
*Designing • Consulting*
Industrial Plants Office Buildings
Stadiums Grand Stands Field Houses
Bridges Garages Laboratories
**7016 Euclid Ave. Cleveland 3, Ohio**

**BENHAM ENGINEERING COMPANY**
*and Affiliates*
**Surveys Design & Supervision**
of
Civil Mechanical Electrical
Sanitary Structural
Engineering Projects
and
All Types of Building Construction
**215 N.E. 23rd St., Okla. City 5, Okla.**

**ALFRED H. GRUPPE**
*Consulting Engineer*
Design and Construction Supervision of Bridges, Buildings, Foundations, Concrete and Steel Structures
**828 N. Broadway**
**Milwaukee 2, Wisconsin**

## SOUTHERN

**PALMER & BAKER, ENGINEERS, INC.**
*Consulting Engineers and Architects*
Tunnels, Bridges, Highways, Airports, Industrial Buildings, Harbor Structures, Soils, Materials and Chemical Laboratories
**Mobile, Ala. New Orleans, La.**
**Washington, D. C.**

**JAMES M. DANIEL — JAMES J. LEWIS AND ASSOCIATES**
*Civil and Mining Engineering Consultants*
United States and Foreign
**860 Porter Place • Lexington, Ky.**

**EUSTIS ENGINEERING COMPANY**
**Foundation and Soil Mechanics Investigations**
*Soil Borings Laboratory Tests*
*Foundation Analyses Reports*
**3635 Airline Highway**
**Metairie, Louisiana**

**BEDELL & NELSON ENGINEERS, INC.**
*Consulting Engineers — Architects*
Airports, Buildings & Industrial Structures, City & Site Planning, Harbor Structures, Highways & Bridges, Industrial Plants, Municipal Improvements & Utilities, Reports, Estimates, Design, Supervision
**1200 St. Charles Ave., New Orleans, La.**

**FROMHERZ ENGINEERS**
*Structural • Civil • Sanitary*
Four Generations Since 1867
Water Supply, Sewerage, Structures, Drainage, Foundations, Industrial Waste Disposal, Investigations, Reports, Plans and Specifications, Supervision
**816 Howard Avenue, New Orleans**

**WILLIAM F. GUYTON AND ASSOCIATES**
*Consulting Ground-Water Hydrologists*
Underground Water Supplies
Investigations, Reports, Advice
**307 W. 12th St., Austin 1, Texas**
Phone: GR 7-7165

**SPENCER J. BUCHANAN AND ASSOCIATES, INC.**
*Consulting Engineers*
Soil Mechanics and Foundation Engineering, Earth Dams, Wharves, Airfields, Highways, Drainage, Structural Foundations; Reports, Design, and Field Supervision
**310 Varisco Building, Bryan, Texas**
Phone TAylor 2-3767

**SOIL MECHANICS INCORPORATED**
*Foundation Exploration and Testing Services*
Site Investigations, Soil Borings, Field and Laboratory Testing, Load Tests, Reports
**310 Varisco Building, Bryan, Texas**
Phone TAylor 2-3767
Houston — Phone MOhawk 7-1869

**LOCKWOOD, ANDREWS & NEWNAM**
*Consulting Engineers*
Industrial Plants, Harbors, Public Works Roads, Airport, Structures, Earthworks Mechanical and Electrical
Reports • Design • Supervision
Surveys • Valuations
**Corpus Christi • HOUSTON • Victoria Texas**

**ENGINEERS TESTING LABORATORY, INC.**
*Soil Mechanics and Foundation Engineering*
Soil Borings Laboratory Tests
Foundation Analyses Reports
**2116 Canada Dry St., Houston 23, Texas**
**444 North 9th Street, Baton Rouge, La.**

**McCLELLAND ENGINEERS**
*Soil and Foundation Consultants*
Investigation • Reports
Supervision • Borings and Tests
**2649 N. Main St. Houston 9, Texas**

## WESTERN

**JOHN S. COTTON**
*Consulting Engineer*
Hydroelectric, irrigation, water supply, and multiple purpose projects, flood and erosion control, river basin development planning, dams and their foundations, tunnels, marine structures, valuations, rates.
**24 Evergreen Drive, Kentfield, Calif.**

**DAMES & MOORE**
*Soil Mechanics Engineering*
Los Angeles • San Francisco • Portland
Seattle • Salt Lake City • Chicago
New York • Atlanta • London
**General Offices, 816 West Fifth Street**
**Los Angeles 17, Calif.**

**DANIEL, MANN, JOHNSON, & MENDENHALL**
*Planning — Architecture — Engineering*
Airports Water Supply & Purification
Harbors Storms Drains
Rapid Transit Sewage Treatment Plants
Urban Renewal Municipal Buildings
Traffic & Parking Industrial & Commercial
Reports & Consultations Buildings
**3325 Wilshire Blvd., Los Angeles, Cal.**
**1145 19th St., NW, Washington, D. C.**

**HOLMES & NARVER, INC.**
*Engineers • Constructors*
**Los Angeles — Honolulu**

**C. E. JACOB**
*Groundwater Consultant*
Water Supply, Drainage, Dewatering, Subsidence, Recharging, Salt-Water Control, Statistical Hydrology, Digital and Analog Computation
**P.O. Box 347 Northridge, Calif.**
Cable JACOBWELL Los Angeles
Dickens 5-4990

**KAISER ENGINEERS**
Division of Henry J. Kaiser Company
**ENGINEER • CONTRACTOR**
Investigation • Reports • Valuations
Design • Construction
Crestview 1-2211
**1924 Broadway Oakland, Calif.**

**WOODWARD, CLYDE, SHERARD AND ASSOCIATES**
Soil and Foundation Engineering; Earth Dams; Engineering Geology; Highway and Airport Pavement Design
**1150 28th Street Oakland, California**
**1240 W. Bayaud St., Denver, Colo.**
**Suite 310, V.F.W. Bldg., Kansas City, Mo.**
**4815 Dodge Street, Omaha, Nebraska**

**INTERNATIONAL ENGINEERING COMPANY INC.**
*Engineers*
Investigations • Reports • Design
Procurement • Field Engineering
Domestic and Foreign
**74 New Montgomery St.**
**San Francisco 5, California**

**JACOBS ASSOCIATES**
*Consulting Construction Engineers*
Appraisal o Construction Costs • Methods Analysis • Field Engineering • Job Management • Review of Bidding Documents for Construction Economy • Engineering Geology • Plant and Equipment Design
**503 Market Street**
**San Francisco 5, California**

## FOREIGN

**SAENZ-CANCIO-MARTIN**
*Ingenieros*
**ALVAREZ y GUTIERREZ**
*Arquitectos*
Consulting Engineers and Architects
**Ave. de la Independencia 774**
**Ensanche del Vedado, Habana, Cuba**

**DUMONT-GREER ASSOCIATES**
*Architects-Engineers*
Airports, Port Facilities
Public Works Projects,
Industrial, Urban, Agricultural
and Rural Development
*Design and Construction Supervision*
**1 Rue du Rhone Geneva, Switzerland**
TELEPHONE: 24.63.87

**AMMANN & WHITNEY**
***CONSULTING ENGINEERS***
**111 Eighth Avenue, New York 11, N. Y.**
Buildings, Industrial Plants Airport Facilities
Bridges, Highways, Special Structures
**29 Rue des Pyramides, Paris, France**
**32 Patission Street, Athens, Greece**
**P.O. Box 1423, Tehran, Iran**
**P.O. Box 1498, Addis Ababa, Ethiopia**


# USE THIS PROFESSIONAL CARD DIRECTORY

Participation is restricted to members or firms where one or more of the principals are members of the American Society of Civil Engineers

**Your Card Should Be Among Them • Write Today for Rates**

# Index To Advertisers


Acker Drill Co., Inc. . . . 138
Wm. Ainsworth & Sons, Inc. . . . 155
Allis-Chalmers Manufacturing Company . . . 9
Allis-Chalmers Manufacturing Co., Hydraulic Division . . . 96
Aluminum Company of America . . . 126 and 127
American Bridge Division . . . 115
American-Marietta Company . . . 87
American Pipe and Construction Co. . . . 1
American Steel & Wire Division of United States Steel Corporation . . . 14, 15, 30 and 31
Anthracite Equipment Corporation . . . 147
Armco Drainage & Metal Products, Inc. . . . 12
The Asphalt Institute . . . 90 and 91

Bethlehem Steel Company . . . 4, 89, 111 and 137
Bludworth Marine . . . 131
Borden Metal Products Co. . . . 2
Brown & Brown, Inc. . . . 26
Chas. W. Bruning Co., Inc. . . . 143

Cast Iron Pipe Research Association . . . 19, 20 and 21
Centriline Corporation . . . 27
Chicago Bridge & Iron Company . . . 36
Clipper Manufacturing Co. . . . 157
Columbia-Geneva Steel Division . . . 14, 15, 30 and 31
Concrete Reinforcing Steel Institute . . . 18 and 156

Dorr-Oliver Incorporated . . . 122

Eagle Pencil Company . . . 113
The Earle Gear & Machine Co. . . . 141
Eastman Kodak Company . . . 79
Eberhard Faber . . . 124
Edo Corporation . . . 148
The Eimco Corporation . . . 5

Filotecnica Salmoiraghi Inc. . . . 150

Forney's Inc., Tester Division . . . 26
Franki Foundation Company . . . 11

Gahagan Dredging Corp. . . . 153
The Galion Iron Works & Mfg. Co. . . . 2nd cover
Graver Tank & Mfg. Co., Inc. . . . 155
M. Greenberg's Sons . . . 24
Griffin Wellpoint Corp. . . . 81
C. L. Guild Construction Co. . . . 13
W. & L. E. Gurley . . . 121

The Heltzel Steel Form and Iron Co. . . . 92 and 93
Rodney Hunt Machine Co. . . . 28

Imperial Tracing Cloth . . . 147
The Ingalls Iron Works Company . . . 119
Irving Subway Grating Co., Inc. . . . 130

Johnston Pump Company . . . 149

Kern Instruments Inc. . . . 144
Keuffel & Esser Co. . . . 103

Laclede Steel Co. . . . 123
Lefax . . . 153
Lehigh Portland Cement Company . . . 85
Lenker Manufacturing Company . . . 156
Leupold & Stevens Instruments, Inc. . . . 142
Lock Joint Pipe Co. . . . 4th cover

M & H Valve and Fittings Company . . . 136
Macomber Incorporated . . . 83
The Master Builders Co. . . . 3rd cover
Mayo Tunnel and Mine Equipment . . . 155
W. R. Meadows, Inc. . . . 118
Moretrench Corporation . . . 102 and 152

Naylor Pipe Company . . . 10

Oldsmobile Division, General Motors Corp. . . . 95
Tinius Olsen Testing Machine Co. . . . 114
Ozalid, Division of General Aniline & Film Corporation . . . 101

Phoenix Bridge Company . . . 153
Pittsburgh-Des Moines Steel Co. . . . 23
Portland Cement Association . . . 135
Posey Iron Works, Inc. . . . 134
The Preload Company, Inc. . . . 144

Raymond International Inc. . . . 117
Richmond Screw Anchor Company, Inc. . . . 151
John A. Roebling's Sons Corporation . . . 17

Seaman-Andwall Corporation . . . 34
Servicised Products Corporation . . . 145
Sika Chemical Corporation . . . 139
Sonoco Products Company . . . 120
Spencer, White & Prentis Inc. . . . 32
J. S. Staedtler, Inc. . . . 109
Sverdrup & Parcel Engineering Co. . . . 129

Tennessee Coal & Iron Division . . . 14, 15, 30 and 31
Texas-Asiatic Import Co. . . . 157
The Texas Company . . . 16
Thompson Pipe & Steel Company . . . 131

The Union Metal Manufacturing Co. . . . 94
U. S. Pipe and Foundry Company . . . 6 and 7
United States Steel Corporation . . . 14, 15, 29, 30, 31, 97, 98, 99, 100 and 115
United States Steel Export Company . . . 14, 15, 30, 31 and 115
United States Steel Supply Division . . . 14 and 15
Universal Atlas Cement Division of United States Steel Corporation . . . 29
Universal Form Clamp Co. . . . 8

Venus Pen & Pencil Corp. . . . 131
Vibroflotation Foundation Co. . . . 133
Visking Company, Division of Union Carbide Corporation . . . 22
Voss Belting & Specialty Co. . . . 146

Washington Aluminum Company, Inc. . . . 140
Water Seals, Inc. . . . 151
Charles R. Watts Co. . . . 154
C. H. Wheeler Mfg. Co. . . . 116
Wild Heerbrugg Instruments, Inc. . . . 25
R. D. Wood Company . . . 125

Professional Services . . . 160, 161, 162 and 163



**Advertising Manager**

**James T. Norton**

**Advertising Production Manager**

**Alice M. Doerle**

33 West 39th Street, New York 18, N. Y.

**Representatives**

**EASTERN**

ROBERT S. CYPHER
• 33 West 39th Street, New York 18, N. Y.

**SOUTHEASTERN**

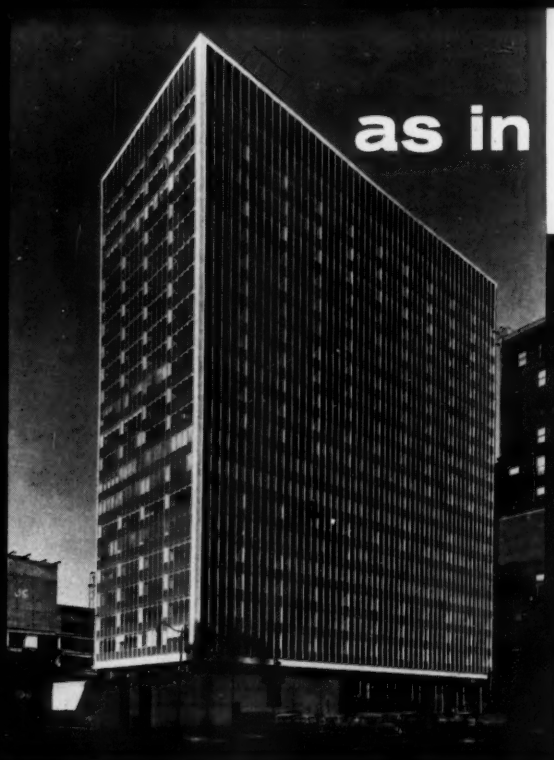
• FRED W. SMITH
1201 Forest View Lane—Vesthaven
Birmingham 9, Ala.

**MID-WESTERN**

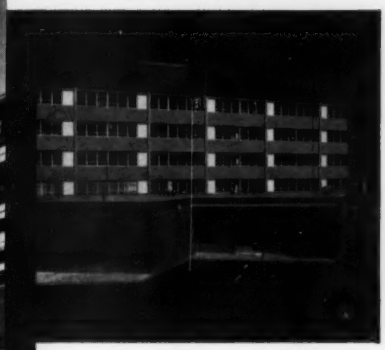
• RICHARD K. HOLMSTROM
84 East Randolph St., Chicago 1, Ill.

**WESTERN**

• McDONALD-THOMPSON COMPANY
625 Market St., San Francisco 5, Calif.
3727 West Sixth St., Los Angeles 5, Calif.
National Bldg., 1008 Western Ave., Seattle 4, Wash.
404 Times Bldg., Portland 4, Ore.
3217 Montrose Boulevard, Houston 6, Texas
620 Sherman Street, Denver 3, Colorado
2010 So. Utica St., Tulsa 4, Okla.

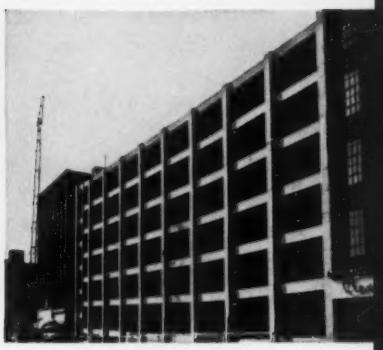


# as in Cleveland Today...



SUBURBAN COMMUNITY HOSPITAL

Arch. & Engr.—Dalton · Dalton Assocs.; G.C.—H. L. Vokes Co.; POZZOLITH Ready-Mixed Concrete—Goff Kirby Co., Cleveland.



WILLIAM TAYLOR SON & COMPANY MODERN PARKING GARAGE

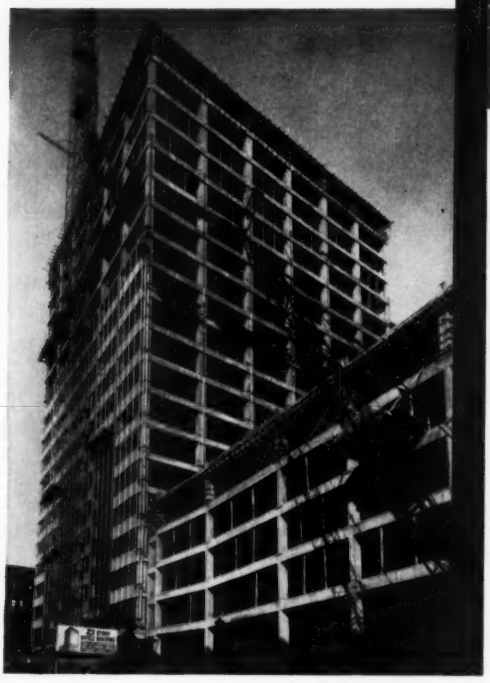
Arch.—Horn & Rhinehart; Contr.—Albert M. Higley Co.; POZZOLITH Ready-Mixed Concrete—Cleveland Builders Supply Co.; All of Cleveland.

THE ILLUMINATING BUILDING

Arch.— Carson & Lundin, N. Y. C.; Engr.— McGeorge-Hargett & Assocs., Cleveland; Contr.— George A. Fuller Co., N. Y. C.; POZZOLITH Lightweight Concrete — Cleveland Builders Supply Co.

THE EAST OHIO BUILDING

Arch.—Emery Roth & Sons, N. Y. C.; Struc. Engr.—Victor Mayper, N. Y. C.; Contr.— Tishman Realty & Construction Co., N. Y. C.; POZZOLITH Lightweight Concrete — Goff-Kirby Co., Cleveland.



"MAY'S-ON-THE-HEIGHTS"—SUBURBAN DEPARTMENT STORE

Arch.— Victor Gruen Assocs., Detroit; Assoc. Arch.— Jack Alan Bialosky, Cleveland; G. C.— Sam W. Emerson Co., Cleveland; POZZOLITH Concrete batched at job-site by the contractor.

## *Where there's progress there's* POZZOLITH *Concrete*

The designers and builders of these fine structures employed POZZOLITH* to obtain concrete of superior quality most economically.

For many years in Cleveland and throughout the country, where careful attention is given to concrete performance and costs, the use of POZZOLITH has been steadily increasing.

You will also benefit by using POZZOLITH, because on *your* job, with *your* materials, neither plain concrete nor concrete with any other admixture can match the results obtained with POZZOLITH.

* POZZOLITH—registered trademark of The Master Builders Company for its concrete admixture that reduces water, controls air entrainment and controls the rate of hardening.

THE MASTER BUILDERS CO.
DIVISION OF AMERICAN-MARIETTA CO.

*General Offices:* Cleveland 3, Ohio • Toronto 9, Ontario • *Export:* New York 17, N. Y.
*Branch Offices In All Principal Cities* • *Cable: Mastmethod, N. Y.*

## A VOTING MACHINE UNLEASHES AN ADDED 300 MILLION GALLONS OF WATER DAILY!

A flick of a lever by an overwhelming number of New Jersey voters set in motion a long range program for supplementing the State's already over-burdened water resources with an additional 300,000,000 gallons of water per day.

The economic future of your community too, depends on farsighted water works planning—such planning deserves to be implemented with the best—LOCK JOINT CONCRETE PRESSURE PIPE.

Durable—low cost—easily installed—LOCK JOINT CONCRETE PRESSURE PIPE, because of its minimum maintenance requirements and permanent high carrying capacity, solves tomorrow's pipe line problems TODAY, economically.

**LOCK JOINT PIPE CO.**

East Orange, New Jersey

Sales Offices: Chicago, Ill. • Columbia, S. C. • Denver, Col. • Detroit, Mich. • Hartford, Conn. • Kansas City, Mo. • Perryman, Md.

Pressure • Water • Sewer • REINFORCED CONCRETE PIPE • Culvert • Subaqueous